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LILLY'S

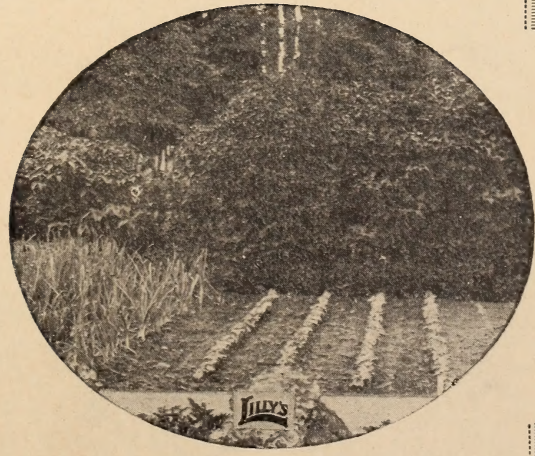
Crop

Book

Seattle, Wash.

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LILLY'S CROP BOOK

This book, intended to meet the requests continually received for information on the planting, cultivation, harvesting, and use of crops, is compiled from numerous dependable sources and includes the cream of a lifetime study and experience of the personnel of The Chas. H. Lilly Co.

United States Government Bulletins, Agricultural Experiment Stations, and many other recognized authorities were consulted and the material furnished was condensed into a concise readable booklet of 64 pages.

The chief usefulness of this book is in its advice on practical problems which we have grouped together under the various headings. In this the tenth edition of this book a new section has been added, namely, "The Cooking of Vegetables."

Credit for this section is due Maria Parloa of the U. S. Department of Agriculture, the recipes can therefore be relied upon as being worthy of trial.

LILLY'S CROP BOOK

Practical Cultural Suggestions for the Western Farm and Garden

By Prominent and Reliable Authorities

THE VEGETABLE GARDEN

Almost anyone can plant seeds, and if he does not treat them too cruelly, they will grow, but to be a successful gardener, requires skill, knowledge and experience. It must be remembered that plants are living things, that they breathe, drink and eat, that if their surroundings are congenial, they will thrive, but if uncongenial, they will struggle along between life and death, and although they may finally reach maturity, they will never reach the state of perfection which will make the gardener proud of his achievement.

Plants are almost human, and it is sometimes surprising that they thrive as well as they do under adverse conditions. Be sure to have good seed. There is little danger of getting poor seed from reliable seedsmen who test all seeds sold. Never buy cheap seed. The little that you save is insignificant compared with a crop failure.

Many persons seem to think that seed must grow regardless of how, where or when planted. Life in seed is wonderfully persistent, but there are some obstacles that it cannot overcome. In nearly every case of failure, the failure is attributed to poor seed, but in 99 cases in every 100 the cause is carelessness in planting or unfavorable conditions of soil or water. Of course some poor seed is sold, but if you purchase tested seed from a reliable seedsman, you will never have a failure on that account.

Frequent causes of failure, are planting too early, too deep, or too late. The thorough preparation of the soil is of the greatest importance. Do not slight it, expecting to remedy it by cultivation after the seed is planted. Do not be satisfied to have the surface smooth, while there are lumps beneath. The spaces between the lumps for the air to circulate in and waste the moisture, for there is the home of the delicate little root of the plant, and a soft bed must be prepared for them.

By all means, have the ground thoroughly pulverized, granulated, and smooth, make the rows straight. If the ground is wet, beds may be raised by cutting paths a few inches deep around them for drainage, but otherwise the garden should be left flat.

Do not plant too early. A few vegetables such as radishes, onions, spinach and peas, may be planted as soon as the ground is in proper condition to work, but most other seeds should not be planted until the weather is settled, and the ground is warm, so that the plants will start to grow properly and keep on growing. Often a few real cold days will give them a set back that they will never recover from. Do not plant too deeply.

An old rule is to plant to a depth of five times the diameter of the seed. The earth should be packed firmly over the seed, especially when the soil is light.

Do not plant too thickly, then as soon as the plants are large enough to get hold of them, thin them severely, leaving plenty of room for them to grow in. It may seem heartless to pull so many good plants, but it is better to have one good plant than several weak spindly ones. Commence cultivating as soon as the plants are large enough, so that you can follow the row. It will pay to have a wheeled cultivator, for you can do better work with a very small percentage of labor, than you can with a hand hoe.

Always cultivate as soon as the ground is dry enough to work, after each rain, or each time that you have irrigated. Shallow cultivation is best, not more than an inch deep, if the soil has been properly prepared before planting. This will keep the soil below the dust mark, mellow and moist during the entire season.

Bear in mind that the main purpose of cultivation is the conservation of moisture and cultivate so frequently and thoroughly that weeds will not have a chance to start.

Another important thing, is to gather your vegetables while they are crisp and fresh. One of the most common errors is that they are allowed to become old or over ripe before being used. Vegetables gathered during the heat of the day are never as good quality, as those gathered early in the morning, nor can wilted vegetables be refreshed by ordinary methods. Radishes become woody and pithy, lettuce becomes bitter, peas are hard and a poor flavor when they get old. Never plant more vegetables of any one kind than can be used up while they are still fresh and in their prime.

THE GARDEN PLAN

W. S. Thornber, State College of Washington.

Just as the carpenter carefully plans every detail of the house before he starts to build so should you draw a definite plan of your garden on paper before you start to plant.

Your plan should be arranged in such a way as to avoid the following troubles:

1. So that tall vegetables will not shade dwarf vegetables.
2. So that plants will not crowd one another and make cultivation or hoeing impossible.
3. So that the slope makes it impossible to irrigate easily.

The plan should be arranged so that the following advantages can be secured:

1. So that you can transplant late vegetables like tomatoes, cabbage or celery on land that has previously produced an early crop of radishes, lettuce or peas.
2. Plant peas in double rows so that one row will support another.
3. If you grow cantaloupes, cucumbers or squash provide room for the vines. This land however, can be used early in spring for early crops.

GARDEN CROP SUGGESTIONS

It is sometimes very difficult to decide just what will be the best garden crop to produce. The only way we can do this is to find out if possible what your land is best suited to and for what your market will pay the most. As a general rule the market problem is the most important one. However, the soil must be carefully considered.

It is always an excellent plan to grow a crop that can be marketed in two or more ways. For example, a good crop of Chantenay carrots may be sold for table use, to a dairyman for cow feed, or fed to hogs at a profit.

Field corn is sometimes marketed as roasting ears, as silo feed for dairy cows, as feed corn when ripe, or used as seed corn.

Tomatoes can be marketed to advantage as fresh fruit, to a cannery at fair price, or canned at home and sold in the can.

If you have an acre or more of good land and your market is not good for vegetables it will probably be better to grow field corn, sunflowers, tomatoes, carrots or onions rather than attempt a large number of vegetables. If, however, you have a small piece of good,

rich soil, intensive crops like head lettuce, celery or peppers will be the most profitable.

Vegetables like carrots and beets may be profitably marketed in bunches during the growing season or converted into an extra fancy product by canning when very small and marketed to a special trade.

If you are favorably located sugar beets for the sugar beet factory may prove to be a very profitable crop if properly handled.

It is not generally advisable to attempt to grow and profitably market novelty crops, like mushrooms, herbs, or similar crops, nevertheless there may be good money in sage, horseradish or even winter rhubarb.

If conveniently located to a good market, and you like the work the culture of violets in cold frames is very profitable. The larger part of the crop will of necessity be ready to market early in spring.

You must study your problems very carefully. It may be advisable to plan to feed a part or all of your crop to sheep, hogs or calves, and that you could get better returns in this way than in any other way.

GARDEN TRICKS

The difference between success and failure in garden work very frequently is in knowing how to overcome a slight difficulty, compel your crop to come on a little earlier or produce more of the extra fancy product and less of the poorer grades.

Some of the following suggestions or "tricks of the trade", if properly worked out, may be of real value to you in your work.

The early potato crop may be made from ten days to two weeks earlier by carefully selecting good, smooth tubers with strong eyes and sprouting them in trays in sunlight two or three weeks before planting them and then cutting and planting, "sprouts upright" in a carefully prepared seed bed. The sprouts must not be long and weak but should be short and strong.

The best way to prevent tomatoes from blighting is to start your plants early. Transplant to pots or tins, produce long, leggy plants, set in the field just as early as you can on land that has been trenched 15 to 18 inches deep. Before planting tomatoes fill the trench from one fourth to one third full of well rotted manure, cover with earth and set the plants in a horizontal position with four or five inches of the top above ground. The

whole stem will soon become a mass of feeding roots and force early heavy fruitage. Where manure is used in the trench be sure to give plenty of irrigation during the hot part of the season.

Many young gardeners have difficulty in getting onion seed to come up at once after planting. This trouble can be overcome by placing the seed in a fine wire strainer placed in a vessel of warm water and soaking from 12 to 24 hours or until the small white sprouts pop from their black covers. **The water must be changed frequently to prevent decay.** It only takes a moment to do this but the seed must be sown in moist warm soil soon after treating. If it becomes too dry the tender germ dies.

It pays to soak all kinds of garden seeds before planting. Soak in warm water from 12 to 24 hours before planting and the plantlets will come up at once and the stand will usually be better than from unsoaked seeds.

If you are very desirous of having extra early cantaloupes, cucumbers, or watermelons start the seed on squares of inverted bluegrass or clover sod in a hotbed, or in berry boxes and when danger of frost is past, transplant the sod or box to the field and protect from the weather for a few days.

HOT BEDS

THEIR USE IN VEGETABLE GARDENING

By A. G. Bouquet, Oregon Agricultural College.

In order that vegetables may be grown to early maturity the plants of several important crops must be started under glass. Some vegetables such as tomatoes, peppers, egg plants require a long warm growing season which fact makes it necessary to start the plants of these crops during the cooler spring months.

Again, crops such as early head lettuce, cabbage and cauliflower may be marketed early in summer largely through having started the plants of these crops under glass.

DEFINITION OF HOTBED.

A hotbed is a bed of manure covered by soil in which the manure, in decomposing

or fermenting, gives off considerable heat which warms the soil and the air in the bed thus providing a suitable atmosphere for young plants to develop.

LOCATION OF BED.

The bed should be in a well drained protected spot. It should also not be too far from the house or barn so that it can be easy to access. Water, too, must be handy for the bed. Excess water in the soil where the bed is located can be drained away by a simple open ditch. Protection should be sufficient to keep off cold driving winds. A facing of the bed to the east or southeast is desirable.

CONSTRUCTION OF BED

THE PIT.

The pit should be dug to fit the sashes used in covering the bed. These are normally 3x6 feet in size. The pit, then, should be 6 feet long (east to west) and some multiple of 3 feet (north to south). The pit should be about 18 inches to 2 feet deep, and should be marked out according to the size of the frame desired. If two sashes are to be used the pit would be a little smaller than 6 feet square.

THE FRAME.

The frame can be made of rough lumber preferably two inch material being best. 2 by 4 inch posts at the corners of the bed can be set in to which the sides and ends of the frame are nailed. If the frame is not to be set up permanently the ends and sides can be hooked together and thus be removable. Back or west board of the frame should be about 14 or 16 inches high, the front or east board 8 to 10 inches. The frame should be made an inch or two slightly smaller than the sash so as to allow for room in raising the sash in ventilation.

SASH.

Standard sashes are 3 feet by 6 feet. They can be bought glazed or unglazed. Glass 10 inches by 12 inches preferably comes in boxes of 50 square feet. The glazing should preferably be done at home. Every sash should be tightly mortised, well glazed and receive at least two coats of paint.

MANURE.

This should be fresh horse manure containing about $\frac{1}{3}$ straw bedding. Too much bedding causes slow heating. The preparation of the manure for the pit should begin about a week before the pit is filled. The manure will at first heat readily, running up to a temperature of 150-170 degrees F. Every second day it should be turned inside out to prevent burning or fire fanging. When the manure seems to be evenly heating throughout, the pit may be filled.

FILLING THE PIT.

The pit is filled in layers of about 4 to

6 inches at a time, some tramping should be done to prevent open air spaces. From 16 to 20 inches of manure (except in the colder portions of the State) will be sufficient.

Above the manure is placed 6 inches of good garden soil containing about $\frac{1}{2}$ rich sandy loam and the rest screened compost and loam. Cover the bed with the sash and let remain for several days until the heat subsides.

SEED SOWING.

This work is best done when the temperature is about 85 to 90°. Then sow about February 20 or March 1 seeds of cabbage, cauliflower, and head lettuce, dropping the seed 6 to 8 to the inch and covering same $\frac{1}{2}$ inch. The furrows should be about 2 inches apart. Figure on obtaining a few more plants than you actually need because of possible troubles such as "damping off" etc. Water the bed thoroughly with a sprinkling can after seeding.

HOT-BED MANAGEMENT.

Considerable care is necessary following the construction of the bed that it be properly looked after.

Ventilation is important especially in seeing that there is no condensation of moisture on the under side of the glass sash. Ventilation must be gradual and opposite to cold wind draughts, aiming to keep the bed warm and yet well aired. 70° is a good temperature at first. As the plants increase in size and are transplanted the temperature may be reduced.

Be sparing in water applications while the weather is moist and cool, otherwise considerable trouble may be had with the damping off disease. When the plants are showing the middle leaf or third leaf plainly it is time they were shifted, usually to a distance of 2 to 2 $\frac{1}{2}$ inches apart each way and 4 inches for tomato, egg plant and pepper. The plants can be reset in the same bed as the seed was sown in or another fresher bed can be made up, in which case the first bed need be only quite small. A hotbed should be giving off heat for four weeks or more after it is first made up.

PREPARATION OF A GOOD SEED BED

By Leonard Hegnauer, Extension Specialist.

The soil should be turned to the depth of 6 or 7 inches or even deeper where conditions will permit. Disking before plowing is especially beneficial in making it possible to pack the loosened soil sufficiently in the bottom of the furrow to allow the moisture to come from below rapidly enough to fully supply the growing crop. If this packing is improperly done there is danger that the seed bed will dry out and a reduction in yield is sure to follow. If the ordinary methods of tillage fail to pack the ground sufficiently it may become necessary to use some type of sub-surface packer to accomplish this result. In many sections fall plowing is very effective in getting the ground in good condition as winter rains and snow will help to settle the loosened soil. After the ground has been carefully plowed, it should be worked up into a good seed bed. Good plowing is of great importance in this connection; never try to turn more than the plow will cut. "Cut and Cover" is a bad practice where a good seed bed is desired. The seed bed should be firm enough underneath to permit water to

come up, and loose enough above to act as a reservoir for the moisture supply and to permit plants to put out their roots and gather plant food materials unhindered. The soil should be crumbly or mealy but never in the form of dust or powder. When the seed bed is finished, place an earth mulch over it to the depth of 2 $\frac{1}{2}$ to 3 inches. The mulch or blanket of earth must not be too heavy otherwise too much of the plowed surface is used as a covering. This will not leave enough loosened soil as a feeding ground for the plants. If the earth mulch is made too fine so that it becomes a dust mulch, it is non-effective. In case of rain, it will run together, will permit greater evaporation, and must be broken up immediately.

If it remains dry, the particles of fine soil will gradually settle to the lower part of the layer and form there a rather dense crust and the mulch again has lost most of its value.

PURPOSE OF THE SEED BED.

In the preparation of the seed bed, it is

well to remember that we must accomplish the following things:

1. Turn under manure, stubble straw or other plant refuse material so that they can be used and not interfere with cropping.
2. Break up the soil and get it in proper tilth.
3. Pack it sufficiently to allow moisture to

come from below to supply the needs of the crop.

4. Get organic matter and soil particles thoroughly mixed so that plant food can become available.
5. Make a suitable place for seeds to germinate and for seedlings to grow properly.
6. To hold and use most effectively the moisture supply available.

PLANTING THE GARDEN

By W. S. Thornber, State College of Washington.

The proper planting of the seeds and plants is one of the most important factors in the making of a successful garden. The reason so many people fail to have a good garden is because there are no hard and fast rules that will work every year. The seed, soil, weather and person making the garden all tend to influence the rules one should follow in garden making. A specific rule that will work one year may not work another and so a gardener must be a good student of nature to know always what is best to do and when to do it.

TIME OF PLANTING.

The time of planting the garden is governed by the season. If it is an early season and the soil is warm and dry one may plant early but if it is a late, cold, wet spring it is better to wait than to try to plant before the soil becomes warm. Most seeds, if planted too early in a cold, wet soil, either rot or become so weakened that they never do well.

Seeds of peas, radishes, onions, beets, lettuce, carrots and spinach may be planted very early, but corn, melons, squash, beans and other tender plants must wait until all danger of late spring frost is past before planting.

HOW TO PLANT.

Always plant in straight rows. If you expect to cultivate with a horse the rows must be at least 18 inches apart and had better be 24 inches. Have the rows as long as possible and save turning. It is sometimes advisable to have the rows in sections but usually it is better to have only one kind of vegetable in a row. I like to plant peas and bush beans in double rows with every other space 24 to 30 inches apart and the row spaces 15 to 18 inches apart. The rows pro-

tect one another and are easier to care for in this manner.

DEPTH TO PLANT.

There is no hard and fast rule for depth of planting. If the season is cold and late do not plant as deep as you would if it were warm and early. Large seeds like peas, beans and corn should be planted deeper than small seeds like carrots, lettuce, turnips and celery. Very small seeds should be planted just as near the surface as can be planted and yet be covered.

FIRMING THE SOIL.

Many people fail to get a good stand of plants because they do not firm the soil around the seed than for all other causes together. When planting seeds like peas, corn, beans and in fact, any kind except the very fine seeds like celery or some of the flower seeds it is best to tramp the row with your feet and then make the surface smooth.

TOOLS FOR CULTURE.

Hand weeders are excellent for small tender plants, and thinning purposes but large tools must be used for working the soil.

The hoe and the rake are very good for larger gardens but the wheel hoe and wheel cultivator are by far the best tools to use in large gardens.

In working the soil keep it just as level as you possibly can and the surface as finely pulverized as your tools can make it.

A well cultivated soil has life and you can detect it by simply walking over it. If it does not give under your feet something is wrong.

Thorough cultivation will frequently take the place of irrigation, however cultivation is better than irrigation for plant growth.

THINNING

The real purpose of thinning is to remove the surplus plants and make it possible for those left to develop fine large uniform specimens. It is frequently as disastrous to neglect the thinning of the vegetables as it is to permit weeds to grow in the row and crowd the little plants.

Extra vegetable plants in the garden really become weeds by taking the moisture, plant food and sunlight that naturally belong to the vegetables.

There are a few vegetables that it ordinarily does not pay to thin, for example if you are growing carrots for stockfeed, do not thin because it does not matter how irregular carrots are in shape and size for the stock, tonnage is what is desired. Carrots to be used for table use should be thinned to one plant to every four inches in non-irrigated sections, and to one every two inches in irrigated sections. Vegetables like carrots, table beets, turnips, salsify, parsnips must not be over grown if the best quality is de-

sired. A small to medium sized root is more preferable than a large one. All plants producing roots like carrots, etc. should have sufficient room for good development but not enough to grow too large.

Onions should be thinned to four or five inches as size is an advantage in onions.

Lettuce should be given plenty of room for good development six to eight inches for leaf and twelve to fifteen inches for head varieties are safe distances.

Permit beets to grow thickly until the small beets begin to form and the tops have become from six to eight inches in height, and then use or market the small beets in bunches as greens. Beet greens are considered a delicate dish by many but are not common in the market.

Lettuce, spinach, mustard cress and similar plants can be thinned and the thinnings marketed to advantage.

If you wish nice, smooth, even-sized potatoes, and a large yield thin your hills to one

or two and never more than three stalks per hill.

Cantaloupes, squashes, pumpkins, water-melons and cucumbers should be thinned to four or five good strong plants per hill just as soon as all danger of bugs, frost or wind is passed.

Thinning is usually done by carefully pulling the extra plants from the hill or row, however, if the soil is dry there is danger

of injuring the roots of the other plants, cut just below the surface of the ground.

Corn in the small garden patch should always be thinned and suckered. It will pay to thin to two strong plants per hill if in hills or one plant in case of drilled corn.

Sometimes it is advisable to replant where the seed has not come up well, however is usually necessary to thoroughly work up the soil and prepare it as for the first planting.

SUCCESSION CROPS

One of the most important factors in successful gardening is to keep the land producing all the time. Most gardens are from once to twice as large as they should be. Instead of a large garden producing small crops why not have a small well enriched garden producing large crops.

Beans
Beets
Cabbage
Carrots

Cauliflower
Corn
Lettuce
Onions

Peas
Radishes
Turnips
Spinach

After the garden is once well started in the spring, a supply of such plants as cabbage, cauliflower and tomato plants should always be ready to set in where some crop has been harvested. By doing this the soil will be kept continually busy.

Interplanting is also a trick that can be used to good advantage. After the early potatoes have attained good size it is an excellent plan to set cabbage or cauliflower between the rows.

One of the most practical crops to plant for a late fall crop is head lettuce. The plants can either be started in frames and transplanted to the field or the seed can be sown where the plants are to be grown.

All early crops should be followed by a second or third crop, because the soil is rich, well prepared and it requires very little time to plant and produce the crop.

The following is a list of good succession crops:

In some of the warmer valleys of the state, fine heads of lettuce can be harvested from the field as late as the holidays or later.

After it seems too late to think of planting anything more for the year, either provide a frame in a secluded spot or corner in the garden, or plant a little patch to spinach or lettuce. Throw a little coarse litter over it and you will be surprised how it will grow and what a surprise you will have early in the spring.

It would be an excellent plan to have a good patch of spinach or young beets to can as greens the last thing before the hard freezes come in the fall.

IRRIGATION OF THE GARDEN

Irrigation must not be made a substitute for cultivation. There is nothing that can take the place of thorough tillage. Watering the surface softens the soil, but does not make the plant food available like cultivation. A combination of irrigation and cultivating is better than an excess of either.

Natural moisture conserved in the soil is better than applied moisture; however, applied moisture is better than no moisture. So conserve all the moisture you can and resort to irrigation only when you are compelled to do so. Soil thoroughly incorporated with manure will retain moisture longer than poor, hard soil.

KINDS OF IRRIGATION.

There are several methods of applying the water to the soil. Some of the more common are as follows:

1. Small ditches
2. Sprinkling
3. Flooding
4. Sub-irrigation.

The small ditch method is the more common one and where the land slopes gradually and water is available it is probably the best, since the leaves are not wet and the water soaks into the soil rapidly.

The sprinkling method is also good for most crops, but may be the cause of inducing rapid spread of certain plant diseases. It is certainly the most attractive method.

The flooding method is common with certain field crops, but not good, as a rule, for garden crops, especially where the soil is not shaded.

Sub-irrigation is effected by placing perforated tile or pipe under ground and forcing water through the perforations. It is an excellent method for certain crops like celery, head lettuce or other crops that have tender foliage that is apt to be injured by moisture.

The method of irrigation used is not so important as the nature of the irrigation. It does plants more harm than good to water lightly. A thorough irrigation followed, as soon as the surface is dry enough to work, with a good cultivation is the ideal method.

HARVESTING AND PREPARING FOR MARKET

Almost anyone can grow a good garden, but very few people know how to prepare vegetables for market.

One of the most common errors is that the crop is not harvested soon enough. It is too late to market radishes after they have become woody or pithy. People want them only when they are fresh and crisp. Lettuce becomes bitter and tough after the leaves grow old. Peas are hard and of poor flavor if not

picked when they are ready; and thus the entire list could be discussed.

Another important thing is to gather the vegetables while they are crisp and fresh. Vegetables gathered during the heat of the day are never of as good quality as those gathered early in the morning; nor can wilted vegetables be freshened by ordinary methods.

After harvesting do not permit the vegetables to become wilted or soiled in any way.

Place them in clean boxes or baskets and keep them in the shade until they are ready for the market. Remember that one poor batch of vegetables prevents you from selling many more to the same market.

PREPARING.

One of the secrets of the trade is to have your products look, smell and taste nice, and to do this they must be put up uniformly, be clean and always fresh.

Green onions, carrots, beets, radishes, and turnips should be carefully washed, surplus leaves cut off, graded and tied with clean string in bunches of convenient size. If you

must market these crops after the roots have become large, be sure to grade carefully; nice, tender, young carrots, half to three-quarters of an inch in diameter cannot be marketed in the same bunch with carrots two inches in diameter.

Peas and string beans should be put up in baskets or boxes if prepared for the home trade. Otherwise they can be marketed at the cannery in clean trays.

CANNING OR DRYING.

Some garden crops can be canned or dried and thus better prepared for market in this way than in any other. This is particularly true of peas, beans, corns, etc.

THE FALL GARDEN

We have become so accustomed to the idea that spring is the only time garden crops can be planted that very few people make use of the fall garden.

If conditions are favorable, that is, the soil is moist and the autumn not too short, it is possible to plant at this time certain garden crops and grow an abundance of fine crisp, tender vegetables for fall use.

The factors must be considered:

1. The soil must be mellow and moist.
2. Thin as soon as the plants are well up.
3. Cultivate and irrigate frequently if the soil is dry.
4. Sow only early vegetables.
5. Firm the soil around the seeds.

There is not a large list of vegetables that can be sown at this time but the few that can will give good results under favorable conditions.

SUGGESTIVE CROPS.

Beets	Lettuce
Crosby Egyptian	Grand Rapids
Early Eclipse	Hanson
Carrots	Peas
Chantenay	Alaska
Earliest Short Horn	American Wonder
Spinach	Turnips
Victoria	Early Purple Top.

Plant the fall garden in the same manner the spring garden is planted and give it the very best of care.

THE WINTER GARDEN

Almost everybody thinks that after the fall garden crop is harvested there is nothing further that can be done to extend the garden season, and so cleans up the tools, puts them away and awaits for spring to come.

The winter garden offers greater opportunity for skill than either the spring or fall garden and while it can never be as successful or extended it is usually more interesting and not infrequently more profitable. There are only a few crops that can be successfully grown in the winter garden, but these are interesting and profitable.

THE HOTBED GARDEN.

One of the most common methods of having a winter garden is to sow such crops as lettuce or spinach in the open during July or August and transplant to a freshly prepared hotbed before the cold weather comes. An-

The fall garden gives an excellent opportunity to produce a quantity of canning vegetables, like beets, carrots, peas and spinach. This is especially true of carrots and beets. Very few people realize the value of these crops, nor can they thoroughly appreciate them until during the winter when fresh tender vegetables are unattainable they can open a can of carrots or beets.

Turnips, in addition to being a good table crop, offer an opportunity for the production of a quantity of food for stock.

1. Harvest and properly store all vegetables.
2. Clean, oil and store all garden tools.
3. Store stakes, garden lines, hose and irrigation pipes.
4. Pile and burn all refuse that cannot be fed to livestock, or used as a fertilizer.
5. Apply a good coat of either well rotted manure, or fresh manure free from straw and litter.
6. Just as soon as the soil can be worked, either spade or plow under the manure and leave rough until spring.
7. Plan on a good hotbed for next year. Dig the pit now and make ready for early spring use.
8. Select from one to two dozen each, nice smooth carrots, parsnips, beets, turnips and rutabagas. Store them in moist sand or soil in a cool, dry cellar to plant early next spring for seed purpose.
9. Complete all records now and determine to your own satisfaction the best varieties for next year.

other very good plan is to carefully prepare a hotbed during September and plant such crops as spinach, radishes, lettuce and onion sets and they will do very well. Instructions for making hotbeds are printed elsewhere in this book.

THE CELLAR GARDEN.

Just before the ground freezes this fall dig or plow out a few old roots of rhubarb, permit them to stay out in the garden until they freeze solid, then carry to the cellar and either plant in boxes or in a corner on the floor covering with moist (not wet) soil or sawdust and you will soon be surprised to see the fine crop of shoots push out from the roots. Occasionally water and your crop will grow with little or no care. Pull the crop as you need it and enjoy fresh rhubarb all through the winter. It is even better than either canned or dried rhubarb.

CULTURAL DIRECTIONS FOR VEGETABLES

ARTICHOKE, GLOBE

There are two distinct varieties of artichokes. The Globe Artichoke resembles a giant thistle, and the edible portion is the immature flower head; also, the young suckers are sometimes served like asparagus.

Deep, rich, sandy loam, with a liberal supply of well-rotted manure, is best suited for growing artichokes. Plant the seed as soon as the soil is warm in spring, and when the plants have formed three or four leaves they may be transplanted to rows three feet apart and two feet apart in the row. The plants do not produce until the second season, and in cold localities some form of covering will be necessary during the winter. This crop is not suited for cultivation where the temperature goes below zero.

After the bed is once established the plants may be reset each year by using the side shoots from the base of the old plants. If not reset the bed will continue to produce for several years, but the burs will not be so large as from new plants. The bur or flower bud, is the part used, and should be gathered before the blossom part appears. If they are removed and no seed is allowed to form, the plants will continue to produce until the end of the season.

The heads, or burs, are prepared for the table by boiling, and are served with melted butter or with cream dressing.

ARTICHOKE, JERUSALEM

The tubers, resembling potatoes, are the edible portion of Jerusalem Artichokes, and although by some they are considered a great delicacy, they are used in this country mostly for hog food.

They will grow in any good garden soil, and should be planted three to four feet apart each way, with three or four small tubers in a hill. If large tubers are used for planting they should be cut the same as potatoes.

Plant as soon as the ground becomes warm in spring, and cultivate the same as for corn. The tubers will be ready for use in October, and may remain in the ground and be dug at any time during the winter.

The tubers are prepared for the table by boiling until soft, and are served with butter or creamed. They are also used for salads and pickles. When planted for hog food they are generally left in the ground and the hogs allowed to root them out. They do well on new land and the hogs will do an excellent job of cultivating and subduing the soil.

ASPARAGUS

Asparagus should have a place in every home garden. It can be grown on almost any well-drained soil, but will do best on a deep, mellow, sandy loam. There is little possibility of having the land too rich, and liberal applications of partly rotted barnyard manure should be made before the plants are set.

One ounce of seed will produce about five hundred plants. One hundred to two hundred plants will produce all the sprouts required in an ordinary home garden. To produce the plants from seed, sow early in spring, one inch deep, in drills twelve to eighteen inches apart, and thin the plants to four inches apart in the rows. As the seed germinates very slowly, it is advisable to mix radish seed with it to mark the rows for cultivating.

The plants will be large enough for transplanting to the permanent bed when one year old, and are considered better at that age than when older, but may be left until the second year if desired. They should be cultivated

thoroughly during the summer, and in the fall the tops should be cut off close to the ground and the bed mulched with manure.

As the permanent bed should last for twenty years or more, much care should be taken in its preparation. It is essential that the land should be in a high state of cultivation. It should be loosened very deeply, either by subsoil plowing or deep spading, and a very heavy application of manure should be plowed under deeply. In addition to this, kainit at the rate of one thousand pounds or more per acre will be very beneficial. The ground should then be harrowed repeatedly until it is thoroughly pulverized.

It is best to transplant in the spring, any time before the first of June, but on the Pacific Coast, where the winters are mild, it could be done in the fall.

Make furrows eight inches deep and three to four feet apart. Any sprouts that have started should be broken off, and about one-third of the length of the roots should be cut off, making them even. Set them about fourteen inches apart on the bottom of the furrows on little mounds made by pressing the half-closed hand into the soil, and spreading the roots carefully on all sides of these mounds; then cover two or three inches deep. Do not fill the furrows full at this time, but fill them gradually as the plants grow, by cultivation.

Cultivation during the summer should be frequent. No sprouts should be cut during this season. The tops should be allowed to grow until the seed is ripe in the fall, when they should be cut off close to the ground and burned, to avoid scattering the seed. The bed may then be mulched with manure.

As soon as the ground is in proper condition to be worked in the spring it should be thoroughly and deeply cultivated. This may be done with a harrow, or even with a plow if it does not cut too deep, and no attention need be paid to the rows for the roots, being deep in the ground, will not be harmed if the cultivating is done early in spring.

Kainit is the best fertilizer for asparagus, and it will be found profitable to apply it early each spring at the rate of about one-half ton per acre. It should be applied broadcast and harrowed in.

Some of the sprouts may be used the second year. They should not be cut after about the middle of June, when the bed should be mulched with manure and the tops allowed to grow until the seed is ripe, then cut close to the ground and burned.

The next and following seasons will be a repetition of this, except that full crops will be produced.

The sprouts should be cut when the proper size, whether needed or not, for if permitted to grow they retard the growth of new sprouts. They should be cut two inches high, care being taken to not injure the crowns of the plants.

These instructions are for producing the green tips. If blanched asparagus is preferred light soil or the mulch should be ridged over the rows, forcing the sprouts to grow up through it, and cutting four or five inches below the surface.

BEANS

Bush beans are easy to grow, and for that reason are more extensively grown than the pole varieties. They should not be planted until late in spring, after all danger of frost and chilly weather are past and the soil is thoroughly warmed. For succession plant at intervals of a week or two weeks until the

middle of June. A warm, rich, rather heavy soil is best, and they will stand heavy fertilization with a fertilizer in which phosphoric acid and potash predominates, as an excess of nitrogen will cause a too rank growth of foliage at the expense of beans and pods. The ground should be carefully prepared the same as for any other garden crop, and the seed sown two to four inches apart and two inches deep in drills two to three feet apart, according to whether to be cultivated with horse or by hand. Beans should not be cultivated while wet with dew or rain.

Pole beans require the same soil and weather conditions. Poles, six feet long, should be set firmly in the ground three to four feet apart each way, and around the base of these six to ten seeds should be planted two inches deep. The plants should be thinned to three of the strongest plants to each hill after danger of insects is past. It is usually necessary to give them a little help in starting to wind around the poles; they always wind from right to left.

Tall lima beans will not succeed in the Northwest, but the dwarf limas are more or less successful. The culture is the same as for bush beans, except that they are even less hardy and should be planted a week later.

BEETS—TABLE

The round, or turnip, varieties are grown for summer use. The long varieties are grown for winter use, and on the Pacific Coast may be left in the ground all winter and pulled from time to time as needed. A rich sandy soil is most suitable. The seed will germinate much quicker if hot water is poured on it and left to soak a day or more before planting. Sow the seed in drills twelve to thirty inches apart, according to whether to be cultivated by hand or with a horse, covering the seed one inch deep. Plant very early in spring, and for succession plant turnip varieties at intervals of two or three weeks until the middle of July. Thin the plants to three or four inches apart in the row. The young plants which are pulled out make splendid greens. For extra early, a few plants may be started in the hotbed and transplanted to the garden.

BEETS—STOCK, (MANGEL AND SUGAR)

The culture is about the same as for table beets, except that as they are generally cultivated with a horse, the rows should be twenty-four to thirty inches apart, and they should be thinned to about six inches apart in the row. They make splendid stock and poultry food, produce wonderful crops in the Northwest, and should be more generally grown.

An article on the subject appears elsewhere in this book under the head of Root Crops.

BROCCOLI

This is a winter substitute for cauliflower, to which it is similar but harder and inferior. The culture is the same as for cauliflower, but it matures much later, and on the Pacific Coast may be left in the ground until wanted for use during the winter.

BRUSSELS SPROUTS

Closely related to cabbage and cauliflower, and grown in the same manner. Instead of a single head, Brussels sprouts form a large number of small heads in the axils of the leaves.

As the heads begin to crowd, the leaves should be broken from the stem of the plant to give them more room. A few leaves should be left at the top of the stem where the new heads are being formed.

Brussels sprouts are more hardy than cabbage, and in mild climates may remain in the

open ground all winter, the heads being removed as desired. For winter use in cold localities, take up plants that are well laden with heads and set them close together in a pit, cold frame or cellar, with a little soil around the roots.

The uses of Brussels sprouts are similar to those of cabbage, but they are considered to be of a superior flavor.

CABBAGE

One ounce of seed should produce 1,500 to 2,500 plants. Seed of the early varieties may be sown in seed bed in September and transplanted to cold frame to be wintered over, or may be sown in hotbed in January or February and the plants transplanted to cold frame when large enough.

Seed of the second early or summer varieties should be sown in seed bed or cold frame early in April, and of the late or winter varieties in May or June. The plants will be greatly improved by transplanting once before setting out in the garden or field.

Plants of the early varieties should be set out as soon as the ground is in good condition to work. They should be set twelve to eighteen inches apart in the rows and the rows should be two to three feet apart, according to whether to be cultivated with horse or by hand. These should be ready for use in June.

The second-early varieties should be set out in May and should mature in July and August.

Late varieties, for winter use, are set out in July, sixteen to twenty-four inches apart in rows two to three feet apart. They mature in October or November. In the mild climate of the Pacific Coast they may be left in the ground until wanted for use during the winter. In colder climates they may be placed, heads down, in trenches, and covered with sufficient straw and dirt to keep them from freezing.

The plants should always be set in the ground on a cool, wet day, or immediately after a heavy rain, while the ground is wet.

Sometimes the seed is sown in drills, where the cabbages are to grow, and the plants thinned to the proper distances apart. Although this method may be successful, it is not generally practiced.

Cabbage is a cool weather crop, does not thrive in very hot weather, and makes the best growth in spring and fall. Our cool, moist climate in the Pacific Northwest makes this an ideal locality for growing cabbage.

The soil for starting the plants should be carefully prepared and cultivated, but should not be extremely rich, for it would produce plants too quickly, making them too succulent and not sufficiently hardy to stand transplanting. But the land for growing the cabbage should be made very rich by applying large quantities of well-rotted stable manure and commercial fertilizers containing large proportions of nitrogen and potash.

Cabbage may be grown on most any good soil, but, especially early cabbage, prefer a light, rich loam.

It is useless to attempt to grow cabbage on poor soil or careless preparation and cultivation. Cultivation should be frequent, thorough, and shallow, to conserve moisture.

Quick-growing crops, such as lettuce, radishes, etc., may be grown between the rows of cabbage, and will be out of the way before the cabbage requires the space. Late cabbage may be grown after some early harvested crop is out of the way, or early cabbage may be harvested in time to plant a late crop on the same ground.

The worst enemies of cabbage are cabbage worms, green aphid, and root maggots. They must be watched very closely. Cabbage worms are early controlled with arsenate of lead.

Although arsenate of lead is a poison, it is perfectly safe to use before the cabbage have neared maturity, for cabbage grows from the inside, and none of the poison is retained in the head. Any nicotine solution, such as Black Leaf 40, is a cure for green aphid. Root maggots are the most troublesome, for there has not yet been found any sure and practical cure for them.

CARROT

Carrots, like other root crops, do best in a rich, sandy loam, thoroughly tilled. For early carrots, sow the seed as soon as the ground is in good condition in spring, in rows twelve to fifteen inches apart, thinning the plants to about three inches apart in the row. For later crops the seed may be sown any time up to the middle of June.

Carrot seed is rather slow to germinate, and radish seed may be sown with it to mark the rows to aid in cultivation.

They do well in the Northwest, and are valuable for stock food as well as for the table. In the mild climate west of the Cascades they may be left in the ground during the winter.

One ounce of seed is sufficient for about one hundred and twenty-five feet of drill, or four pounds for an acre.

CAULIFLOWER

Cultivation and soil should be very much the same as for cabbage, but it is more difficult to grow. To produce perfect heads cauliflower requires a cool, moist season and a rich, moist, loamy soil. In the Sound country cauliflower does exceedingly well in the average season. For a spring or early summer crop sow in March or early in April, in hotbed, and transplant to a cold frame when sufficiently large, and to the open ground as soon as danger of hard freezing is over. For a late crop sow at the same time as for late cabbage and treat in the same manner. With the early cauliflower, when the heads begin to form, the leaves should be brought over and tied around the heads to blanch them. The heads should be cut for use when the "curl" is very compact or hard, as they soon become tough and bitter after they open and separate into branches. Best results will be obtained by planting either very early or very late, in order to avoid the hot mid-summer season when heads are being formed.

CELERIAC

A large-rooted form of celery of which the root is the edible portion, and is used for cooking. The plants may be started the same as celery, and transplanted about five inches apart in rows two feet apart. Cultivation is the same as for celery, but blanching is not required. The roots may be left in the ground during the winter, until wanted for use, but in cold localities should be mulched to prevent freezing.

CELERY

Sow the seed in hotbed, cold frame or seed bed early in spring. Transplanting once or twice before setting the plants in the garden will be very beneficial. The tops should be clipped off to induce stockiness, and when transplanting, the ends of the roots should be cut off.

Celery requires a deep, very rich, moist soil. Fresh stable manure is liable to make the celery coarse, stringy, and of inferior flavor, but well-rotted manure may be used if applied some time before planting. Kainit is very beneficial for celery, the same as for asparagus, and should be used in large quantities, one thousand pounds, or more, per acre.

The plants may be set in the garden after some early harvested crop has been removed. They should be set six inches apart in rows

three feet apart. They should be given frequent shallow cultivation.

When the plants have attained considerable size, the leaves should be drawn up and a little soil compacted about the base of the plants to hold them upright.

There are several ways of blanching the plants, but the favorite method is with boards. When the plants are a little more than a foot high, set twelve inch boards on edge close to the plants on both sides of the row. Let the tops of the boards lean together against the plants so that they will be only two or three inches apart. Hold the boards in this position by nailing cleats across the tops. A few of the leaves will show above the boards. The foliage will soon fill the space, excluding the light, and the stalks will be blanched in ten to twenty days.

If the plants are blanched with earth, care must be taken that the crowns do not become filled.

Celery may be kept for winter use by banking with earth and covering the tops with leaves or straw to keep it from freezing. Or it may be dug and removed to a cellar, cold frame, vacant hotbed, or pit, and reset close together with the roots bedded in earth. While in storage it should be kept as cool as possible without freezing.

The seed is slow to germinate, and the seed bed must be in perfect condition. One ounce of seed will produce about three thousand plants; one pound will produce plants for an acre.

CHERVIL

Seed of Curled Chervil may be sown in well-prepared ground at any time during the spring. Culture is the same as for parsley. The rows should be about twelve inches apart and the plants thinned to four inches apart in the row. The leaves are used the same as parsley, for garnishing and for flavoring soups.

CHICORY

Chicory is used for several purposes. The roots are used to adulterate coffee; the leaves are used like spinach; or the tender, blanched leaves are eaten raw as salad or are boiled and used as greens.

The culture is the same as for carrots. A deep, rich, loam soil is required. The seed should be sown early in spring in rows twelve inches apart, and the plants thinned to two or three inches.

When used like spinach, the leaves should be boiled in two waters to remove the bitter taste. To blanch the leaves for salad or greens, the roots are dug in fall and planted in a cellar or under a greenhouse bench.

CHIVES

Chives, or Schnittlauch, are hardy perennial plants, resembling small onions in appearance, and growing in clusters. They are grown for the young leaves, which are produced freely early in spring and throughout the summer. The leaves are cut off close to the ground when wanted, and are used in soups, salads, sausages, etc., imparting a mild onion flavor.

Seed may be sown the same as onions, and the plants transplanted or thinned; or clumps of plants may be obtained from your seedsman. Large clumps should be divided, and placed about a foot apart in a part of the garden where they may remain for several years.

COLLARDS

The Georgia Collard is a non-heading form of cabbage, grown extensively in the south for greens. Culture is the same as for late cabbages. They are best after having been touched by frost.

CORN—SWEET

Sweet Corn should be planted as soon as the soil is thoroughly warmed in spring, and successive plantings should be made at intervals of two weeks; or early, medium and late varieties planted; for succession. It is very sensitive to frost, and early plantings may be killed, but it is neither much trouble or expense to replant. If the early plantings are not killed the result will be worth taking a chance for.

In our cool climate west of the Cascade Mountains, to grow corn successfully, a rich, light, warm soil must be selected, and it must be highly cultivated and fertilized. Light applications of nitrate of soda or nitrate of lime early in the growing season will help to give it a good start.

The seed may be planted in drills three feet apart and the plants thinned to a single stalk every foot in the rows, or five or six kernels may be planted in hills three feet apart each way and thinned to three plants in each hill.

Large quantities of commercial fertilizers should be used, with potash and phosphoric acid predominating. Nitrates should be used early in the season only, as they tend to retard maturity. Cultivation should be frequent and thorough, and, especially after spring rains have ceased, should be shallow.

One pound of seed is sufficient for about two hundred hills; fifteen pounds for an acre.

CORN SALAD

Corn Salad, also known as Fetticus and Lamb's Lettuce, is used as a salad or substitute for lettuce. The seed is sown early in spring the same as lettuce, or for an extra early crop the seed may be sown in fall and when cold weather begins protected with a light mulch of straw or other coarse material. The leaves may be used in their natural green state, or they may be blanched by covering the rows with anything that will exclude the light.

CRESS

There are two forms of cress, Water Cress and Garden Cress or Peppergrass. Peppergrass is sown in any good garden soil in drills a foot apart. The plants last but a short time, and if a continuous supply is desired it will be necessary to sow at intervals of a week or two during the spring and summer. It is a pungent plant and is used as a salad.

Water Cress must be grown in shallow water, and the seed is simply scattered at the edge of a stream or pond.

CUCUMBER

Cucumber plants are very tender, will not endure frost or chilly weather, and should not be planted out of doors until late in spring after the weather is thoroughly settled and the soil is warm. They require a light, rich, warm, porous soil, very heavily fertilized. It is difficult in the Puget Sound country to make them mature all their fruit before being killed by frost in the fall, and they must be forced in every way possible. The plants may be started in berry boxes or on inverted pieces of sod in the kitchen window or in the hot-bed, planting a half dozen or more seeds in each box or sod the latter part of April. By the time that they should be planted out of doors they will have attained a height of eight or ten inches and will be about ready to vine. Set in the garden a little deeper than they stood in the boxes, removing the boxes without disturbing the soil around the roots. After danger from beetles is past thin to three plants to the hill.

There are many methods of planting. Some plant in hills six feet apart each way; others plant in hills six by two or three feet, and others in drills six feet apart, thinning the plants to one foot apart in the rows after danger of

destruction by beetles is past. We prefer the latter method. A row of beans or peas may be planted between each two rows of cucumbers. They will protect the cucumbers and will be removed before the space is required by them. The seed should be planted about one inch deep, and enough seed should be planted so there will be plenty of good plants after the beetles have finished their depredations. It seems to be impossible to entirely eliminate cucumber beetles, but their depredations may be controlled to some extent by dusting the plants and the ground around the plants frequently with tobacco powder. Or the plants may be covered with mosquito netting.

Pick all of the cucumbers before they begin to mature, for as soon as the vines begin to mature fruit they cease to produce.

DANDELION

In the lawn, dandelions are a very troublesome weed, but when properly grown and cultivated they make delicious greens. Being perennials, they should be placed in a part of the garden where they may remain for several years. They should not be allowed to go to seed.

The seed should be sown in spring in rows a foot apart and the plants thinned to eight to twelve inches. They will produce greens early the following spring. The quality is greatly improved by blanching. This may be done by placing boards over the rows in the form of an inverted trough, to exclude the light.

EGG PLANT

Makes a very satisfactory crop in the Yakima Valley and other favored sections of the Northwest, but will not mature fruit in the Sound country. Plants should be started under glass and should be six to eight inches high when set out. Transplanting should not take place until the weather is warm and all danger of frost is past. The better plan is to start them in two or three-inch pots or berry boxes. They require a rich loamy soil.

ENDIVE

A fine salad vegetable that does exceedingly well in all sections of the Northwest. During the summer and in the dryer and hotter sections it is superior to lettuce. Cultivation and soil required are the same as for lettuce.

GARLIC

Garlic is closely allied to the onion, but will remain in the ground from one year to another if undisturbed. It is planted by setting the small bulbs, or cloves, either in fall or early spring. The culture is practically the same as for onions. The bulbs are used for flavoring.

HORSERADISH

Grows best in rich, cool, clay loams. Seldom produces seed and is generally started by setting out small plants. Should be planted in rows two and a half feet apart and 10 to 12 inches in the row. It is best to plant rather late in the spring. Sets planted in May, small end down, with top one inch below surface, will form radish of large size in one season's growth. Do not plant horseradish in places where you do not want it permanently, as it is hard to get rid of. Use very little, if any, stable manure, as it contains too much nitrogen.

KALE

Grown for supplying greens during the fall, winter and spring; also used for garnishing. For winter use, sow in September in drills eighteen inches apart, covering the seed one inch deep, and thin to twelve inches apart in the rows. The young plants which are thinned out may be used for greens like spinach. The plants are hardy and are left in the ground

until wanted for use. Frost improves the quality. For summer use, plant very early in spring. The soil should be very rich.

KOHL-RABI

This belongs to the cabbage family, and the seed resembles cabbage seed. The edible portion is the peculiar swollen stem just above the ground. It is used and grown the same as turnips. Where it is well known it is more highly esteemed than turnips for early summer use. Like turnips, it should be sown in drills very early in spring, and used while young and tender, or for winter use it may be sown in July or August, and can be stored the same as turnips.

LEEK

Belongs to the same class as onions, but requires different treatment. The seed is usually sown in the bottom of a shallow trench, and the plants thinned to about four inches apart in the row. The trench will be filled gradually by cultivation as the plants grow, and when they have attained nearly full size the earth is drawn around them to a height of six or eight inches to blanch the fleshy stem.

The leek does not form a true bulb like the onion, but the stem is uniformly thick throughout. They are marketed in bunches like young onions. They may be stored for winter use the same as celery.

LETTUCE

For early crop sow the seed in hotbed in February or early March; transplant the seedlings to coldframes or flats, and when the ground is warm enough transplant to the garden in rows a foot apart and eight to twelve inches apart in the rows.

For general crop, sow when ground is in good condition to work in spring in rows a foot apart and thin the plants to six or eight inches apart. For succession sow at intervals of two or three weeks. The plants which are thinned out may be transplanted to other rows.

Some use only a part of the leaves from the plants, allowing the plants to continue to grow; or allow them to grow thickly in the rows and thin as wanted for use; but it is much better to thin the plants when they are small, allow them to form heads, and use the entire heads.

Lettuce does best in the cool weather in spring and fall. That grown during the hot weather in summer should be protected from the sun, or planted in the shade of some taller crop. It is best when grown quickly, and frequent light applications of nitrate of soda will be very beneficial. A rich, warm, sandy loam soil is best.

The seed may be sown in fall and the plants wintered over in cold frames, like early cabbages.

MELON—MUSKMELON OR CANTALOUPE

The muskmelon is a long season crop, and when grown west of the Cascade Mountains conditions must be favorable and they must be encouraged in every way possible to insure success. The soil must be a warm, sandy loam with an abundance of well-rotted manure and commercial fertilizers. Nitrate of soda may be used as suggested elsewhere in this book under the head of Nitrate of Soda for Garden Crops.

For an early crop, or for main crop in other than the most favorable localities, the plants should be started in berry boxes or on inverted sods as suggested on page 7.

In warmer localities the seed may be planted, when weather is settled and the soil is thoroughly warmed in spring, in hills six feet apart each way, eight or ten seeds in each hill, and thinned to four plants to the hill. Or the seed may be sown in drills and the plants

thinned to eighteen to twenty-four inches apart when they have become thoroughly established. Rows of short season crops may be planted between the rows of muskmelons.

Muskmelons are subject to a number of diseases and pests. While the plants are young they are attacked by the cucumber beetle, and the same precautions should be taken as with cucumbers.

MELON—WATERMELON

The cultivation of the watermelon is practically the same as for the muskmelon, except that the plants grow larger and require more room. They should be set in hills ten feet apart each way, or in drills ten feet apart and the plants thinned to three feet apart in the rows. The young plants are also subject to attack by cucumber beetles.

MUSHROOMS

The most important conditions in mushroom growing are proper and uniform temperature and very rich soil. The most suitable place is a cellar, but they may be grown in any place where the temperature can be kept at 50 to 70 degrees, as near 55 degrees as possible. The place may be either dark or light.

Mix thoroughly three parts fresh horse manure, free from straw, and one part rich loam soil. Make it into a compact pile and allow it to stand for a few days until it becomes heated, then fork it over and allow it to stand until it again becomes heated, when it will be ready for the bed. Make the beds about four feet wide, so that you can reach all parts without tramping on them, and any desired length. If the room is heated, so that manure is not needed to produce heat, six or eight inches will be sufficiently deep to make the beds, but otherwise they should be made twelve to eighteen inches deep.

In making up the beds shake the manure loosely, and spread it evenly over the bed, beating it down firmly with the fork as you go along, continuing until the desired depth is attained, then tread it down firmly and evenly. Insert a hot bed thermometer in the bed. Within a few days the temperature should rise to 110 or 120 degrees. Never spawn the bed while the temperature is rising, but when it has subsided to below 90 degrees the bed is ready to spawn.

Mushroom spawn is put up in two forms. What is known as English spawn is preserved in horse manure pressed in the form of bricks, and is preferred by most growers. French spawn is not pressed in bricks, but is handled in the form of flakes, in bulk. One pound of English spawn will spawn about ten square feet of bed.

Cut a brick of spawn into about twelve equal pieces, and insert the pieces in the bed about ten inches apart and one to two inches below the surface. The bed should then be firmed down evenly and covered with two inches of rich loamy soil. Some prefer not to cover with soil until five to ten days after the spawn has been inserted, but this seems to be only a matter of choice.

Do not water the bed if it can be avoided, but if they become dry should be moistened with a fine spray.

If the temperature is right you may expect mushrooms in six to eight weeks, and the beds will bear about thirty days. After the first crop is removed spread over the bed an inch of loam and moisten with water.

OKRA, OR GUMBO

Sow the seed in the open after the ground has become quite warm, or start the plants in berry boxes in a hotbed and transplant them to the garden after all danger of frost is past.

The rows should be four feet apart for the dwarf sorts or five feet apart for the tall kinds, with the plants two feet apart in the rows.

Okra does best in rather rich land and requires frequent shallow cultivation until the plants cover the ground.

The young pods are the part used, and these are employed principally in soups, and while they impart a pleasant flavor and mucilaginous consistency. If the pods are removed from the plants, and none are allowed to ripen, the plants will continue to produce pods until killed by frost, but the best pods are grown on young plants. The pods can be dried or canned for winter use.

ONION

For young onions, sets are generally planted in rows about 12 or 14 inches apart and about one and a half inches apart in the row. This will give very early green onions.

For dried onions, seed is sown, and it requires a rich, well-drained loam. No other soil should be used if it can possibly be avoided. The land should be very rich and it is absolutely necessary that it should have raised a hoed crop the previous season. It is a mistake to attempt to grow onions on weedy or rundown land. To get the best results a heavy top dressing of well-rotted barnyard manure should be well worked into the soil. After this a complete commercial fertilizer containing a large proportion of potash should be used. This should be sown broadcast at the rate of 1,000 pounds per acre. If the land has been in a high state of cultivation the commercial fertilizer may replace the barnyard manure. Onion soil, however, must be very rich. The most successful growers use, in addition to the above, about five hundred pounds per acre of nitrate of soda, applied broadcast in three or four light applications early in the season. It must not be used later, as it will retard maturity.

The cost of growing and cultivating onions is very high, and it must be borne in mind that it costs no more to cultivate a crop that yields 800 bushels per acre than it does to cultivate a crop that yields only 300 bushels. When land is in good condition onions may be grown on it from year to year. Seed should be sown as early in the spring as the land can be worked. If intended for hand cultivation, sow in rows 12 to 14 inches apart, and if for horse cultivation about 30 inches apart. It requires from three to six pounds of seed per acre.

For those who intend raising many onions it will be money well spent to get one of the many good books published in reference to the production of this crop. It will pay to buy the best seed and from reliable sources, as onion seed loses its vitality after the first year.

PARSLEY

Parsley seed germinates very slowly, and should be soaked several hours in warm water before planting. Sow the seed early in spring in drills one foot apart. It is well to sow radish seed with it to mark the rows for cultivation. Thin the plants to four inches.

In mild climates it will live outdoors during the winter if given a light mulch. In colder climates the plants may be transplanted to cold frames for winter use. The leaves are used for garnishing meats and for flavoring soups.

PARSNIP

Sow the seed in a rich, deep soil, early in spring, in drills eighteen inches apart and thin the plants to three inches apart. Give frequent shallow cultivation during the summer. The roots may remain in the ground until wanted for use during the winter. They are improved by freezing.

Roots not used during the winter should be dug in spring, for they will produce seed and become weeds. Parsnips that have run wild are considered poisonous.

PEAS

Peas are easy to grow, and not very particular in regard to soil or weather, but they do best in a rich clay loam and while the weather is not too hot or dry. Early peas will be produced earlier on light, warm soil.

Stable manure or other highly nitrogenous fertilizers should not be applied immediately before planting the seed, as they are liable to cause an excessive growth of vines at the expense of pods. It is better to apply the manure the previous season, or to use commercial fertilizers containing large proportions of phosphoric acid and potash.

The seed should be sown in drills very early in spring, as soon as the ground is in good condition to work, and covered two or three inches deep. Rows of the extremely dwarf varieties may be as close as twelve to eighteen inches apart; the semi-dwarf and tall varieties should be two to four feet apart.

Some sow the seed in double rows six inches apart, placing trellis or brush between the rows, thus making one row of supports do for two rows of peas.

For succession seed should be sown at intervals of about two weeks until the middle of June. They do not do well in hot weather in summer, but good crops may again be produced in the fall.

On the Pacific Coast, where the winters are mild, the seed may be planted in rather light, porous, well-drained soil in November, as instructed elsewhere for Sweet Peas, and will be ready for use early in June.

One pound of seed is sufficient for fifty to seventy-five feet of drill, two hundred pounds for an acre.

PEPPER

Peppers are a very uncertain crop west of the Cascade Mountains, and the plants should be started in berry boxes or on inverted sods as described for melons. In warmer climates the plants may be started under glass the same as tomatoes. They should not be planted outdoors until very late in spring, after the weather and soil are thoroughly warmed. The plants should be set about thirty inches apart each way in well-tilled rich soil.

POTATO

U. S. Dept. of Agriculture; Farmers' Bulletin
No. 255.

A rich, sandy loam is best suited to the production of Irish potatoes, and the fertilizers employed should contain high percentages of potash. The main crop of Irish potatoes for family use should be grown elsewhere, but a small area of early ones properly belongs to the garden. The preparation of the soil should be the same as for general garden crops.

Early potatoes should be planted as early in the spring as it is feasible to work the land. Late potatoes should be planted late in May or during June. The rows should be two and one-half to three feet apart, and the hills fourteen to eighteen inches apart in the row.

Lay off the rows with a one-horse plow or lister, and drop the seed, one in a place, in the bottom of the furrow. Cover the seed to a depth of about four inches, using a hoe or one-horse plow for the purpose.

One to three weeks will be required for the potatoes to come up, depending entirely upon the temperature of the soil. The ground may freeze slightly after the planting has been done, but so long as the frost does not reach the seed potatoes no harm will result, and growth will begin as soon as the soil becomes sufficiently warm.

As soon as the potatoes appear above the ground and the rows can be followed, the surface soil should be well stirred by means of one of the harrow-toothed cultivators. Good

cultivation should be maintained throughout the growing season, with occasional hand hoeing, if necessary, to keep the ground free from weeds. Toward the last the soil may be well worked up around the plants to hold them erect and protect the tubers from the sun after the vines begin to die.

After digging the potatoes they should not be allowed to lie exposed to the sun or to any light while in storage, as they will soon become green and unfit for table use. Early potatoes especially should not be stored in a damp place during the heated period of the summer, and will keep best if covered with straw in a cool, shady shed until the autumn weather sets in, after which they can be placed in a dry cellar or buried in the open ground. The ideal temperature for keeping Irish potatoes is between thirty-six and forty degrees F., but they will not withstand any freezing.

PUMPKIN

Pumpkins thrive best in a warm sandy loam. The seed should not be planted until the ground is thoroughly warmed and all danger of frost is past in spring. It is a common practice to plant them in the corn field in occasional hills at the time corn is planted, or later in hills where corn is missing.

For garden culture the seed should be planted in hills eight feet apart each way, six or eight seeds to a hill, and thinned to three plants to the hill. Where there is danger of their not maturing, the vines should be pruned. Confine each plant to about three runners, and cut off the ends. This throws all of the energy of the plant into producing fruit, and at the same time allows the sunlight to enter.

RADISH

This is a hardy, quick-growing crop, and the seed may be sown as soon as the ground can be worked properly in early spring, and for succession at intervals of ten days or two weeks as long as wanted. The soil should be very rich, light and warm. To make them crisp and brittle they must be grown quickly, and for that purpose one or two applications of nitrate of soda will be very beneficial.

The seed may be sown in drills a foot apart and the plants thinned to about two inches, or the seed may be mixed with seeds of slower growing crops such as lettuce, carrots, parsnips, etc., and the radishes will be used before the other crops need the space.

Winter radishes are grown the same as turnips, and the seed should be sown in the latter part of July or any time in August.

Radishes are very subject to root maggots, the only practical cure for which seems to be to sow the seed in different localities each year.

RHUBARB

Every garden should contain a half dozen good plants of rhubarb. It comes in very early in spring and takes the place of fruit at a time when fruit is scarce.

It may be propagated by dividing the roots of old plants, but best results are obtained by growing or purchasing one-year-old or two-year-old plants grown from seed.

The soil should be a light loam, and extremely rich. In addition, top dressings of stable manure or commercial fertilizers should be applied each year. As they remain for many years, the plants should be set at one side of the garden where they will be out of the way. If more than one row is planted, the rows should be at least four feet apart; the plants should be three feet apart in the row.

Set the plants in trenches, the same as asparagus, so that the crowns will be four or five inches below the surface; cover lightly and gradually fill the trenches by cultivation as the plants grow during the summer. None of the stalks should be used the first season.

The plant should never be allowed to produce seed.

Rhubarb may be forced for winter use by setting large, old roots in a bed of manure, and covering with three or four inches of moist sand, under the benches of a greenhouse, in a cold frame, cellar, pit, or shed. Heat is not essential. Better rhubarb will be produced by excluding the light. Rhubarb outdoors may be produced earlier in spring by covering with a box or barrel to exclude the light.

RUTABAGA

The culture of the rutabaga is the same as for the turnip, except that it requires more room and a longer period for growth. The roots are quite hardy and will withstand considerable frost. They are used for the table like turnips, and are valuable for stock food.

SALSIFY

The culture of salsify, or vegetable oyster, is the same as for parsnips. The roots may be left in the ground until wanted for use during the winter, or they may be dug in the fall and stored in the cellar.

Salsify is deserving of more general cultivation. Its uses are similar to those of the parsnip, and when boiled and afterwards coated with rolled crackers and fried in butter it has a decided flavor of fried oysters.

SPINACH

Spinach is easy to grow, thrives in cool weather, and is valuable for greens during the winter and early spring.

For spring and summer use, sow in drills one foot apart very early in spring and at intervals of two weeks for succession.

For winter and early spring use, sow in September or after other crops have been removed from the ground. Mulch with straw on the approach of very cold weather.

The soil should be light and rich. Light applications of nitrate of soda will greatly improve the quality. In gathering spinach the entire plant is removed rather than merely cutting off the leaves. If not sown too thickly, the only thinning necessary will be to use the larger plants first, giving the smaller plants room to develop.

SQUASH

The early summer varieties of squash do well in all sections of the Northwest, and if given proper care the winter varieties may also be grown in even the most unfavored sections. Where the season is short they may be started by the same method as described for musk melons. They require a warm, fertile soil, preferably sand. The bush varieties of summer squash are grown almost exclusively now, and these should be planted in hills about four feet apart. Winter varieties, such as the Hubbard, should be planted in hills 12 feet each way, for the Hubbard and other long trailing kinds use the same treatment as described for the pumpkin, and no trouble will be had in getting the squash to mature in any section of the Northwest. Care should be used to see that the squash are all picked and stored before the first fall frost, as they are very easily injured. In gathering the winter varieties care should be exercised that the stem is not broken from the squash, and that the fruit is not bruised.

TOBACCO

Tobacco can be grown in the warmer sections of the Northwest. The plants should be started early in spring in hotbed or cold frame and transplanted to the open ground when the weather has become thoroughly settled and warm. Wood ashes should be mixed with the soil, and the plants set four feet apart each way. Cultivation is the same as for corn. Fertilize with sulphate of potash. Do not use muriate of potash, kainit, or other fertilizers containing chlorine.

TOMATO

The plants should be started in a greenhouse, hotbed, or in a warm, light room in February or early in March, and transplanted once or twice before being set outdoors. The best plants are produced by transplanting single plants to pots or berry boxes.

They cannot stand any cold, and should not be set outdoors until the weather is thoroughly warm. The soil should be rich, mellow, and in fine condition. If the plants are not to be pruned they should be set four feet apart each way. They may be set in rows with early maturing crops that will be out of the way before the tomatoes need the room.

West of the Cascade Mountains, where the climate is cool, they must be favored in every way possible. Set the plants two feet apart in rows four feet apart. Prune the plant to a single stem and keep all side shoots and other superfluous growth pruned off, and train the plant to a stake set at each plant. Or set the plants four feet apart, set a stake at each plant and stretch wires along the row of stakes, one twelve inches from the ground and the other thirty inches from the ground. This will form a trellis for the plants, which should be pruned to four stems, which should be trained on the wires.

Pruning increases the size of the fruits, and also permits the sunlight to reach the blossom and fruits, thus promoting a much earlier crop.

TURNIP

Turnips may be grown in any good garden soil, but do best in rich, light, sandy soil. For table use, the early varieties should be sown as soon as the ground is in good condition to

work in spring in drills twelve to fifteen inches apart; the plants should be thinned to three inches apart in the rows. For succession, sow at intervals of about three weeks. Turnips should be used for table while young, before they are full grown. They may be grown during the summer, but do best in cool weather in spring and fall.

For fall and winter use, the seed should be sown in August or September. For stock food, the seed is sometimes sown broadcast in the field after last cultivation of corn or other cultivated crop.

Turnips are quite hardy and need not be harvested until after several frosts. West of the Cascade Mountains they are sometimes left in the ground until wanted for use during the winter. They may be stored in a cellar or buried in a pit.

Rutabagas, or Swedish turnips, are grown in the same manner, but require more room and a longer period for growth.

VEGETABLE MARROW

U. S. Dept. of Agriculture; Farmers' Bulletin No. 255.

The so-called vegetable marrows are closely allied to the pumpkin, both as to species and habit of growth, the principal difference being that the vegetable marrows are used while quite young and tender, and may be baked and served very much the same as sweet potatoes. The vegetable marrows should receive thorough cultivation in order that a tender product may be secured, and should be gathered while the outside skin is still so tender that it may easily be broken by the finger nail. The flesh is either boiled and mashed or baked in the oven and served with butter while hot.

For The Farm

Use 600 to 1200 lbs. per acre.

**For The Garden**

Use 5 lbs. per 100 sq. feet.

For General Purposes

Lilly's Morcrop Fertilizer is the direct result of many years experience with fertilizers. To manufacture a general purpose well balanced fertilizer which we could strongly recommend to our customers has been an ambition we have realized in Morcrop. The use of a commercial fertilizer is becoming so common now that it is only a question of which fertilizer will be suited best for certain conditions and not as to whether one should be used. In Morcrop we have combined the elements necessary to make it a fertilizer suitable for all ordinary purposes.

Lawn Dressing

Apply to the lawn at the rate of one hundred pounds to each 2,000 square feet. For new lawns use 100 lbs. to each 1,000 square feet. Morcrop is nearly odorless and easy to handle. Two or three applications of lesser quantities at intervals throughout the year are more effective than applying above quantity all at one time.

Root Crops

Beets, Mangels, Turnips, Carrots and other root crops require a fertilizer which will give a good start in the earlier stages of growth, but must not be too effective in advanced stages, for it would tend to grow tops at the expense of roots. Morcrop will remain in the soil to feed the root gradually without forcing a growth of tops.

Analysis

Potash	2%	3%
Nitrogen as ammonia	2%	3%
Phosphoric Acid	10%	12%

THE COOKING OF VEGETABLES

By Maria Parloa, U. S. Dept. of Agriculture.

GENERAL PRINCIPLES UNDERLYING VEGETABLE COOKING

Vegetables are baked, roasted, fried, or boiled, are used for making a great variety of dishes, and are prepared for the table in other ways; but the most common method of cooking them is in boiling water. Steaming is not infrequently resorted to as a method of cooking vegetables and is, of course, similar in principle to boiling in water.

The simpler the methods of cooking and serving vegetables the better. A properly grown and well-cooked vegetable will be palatable and readily digestible. Badly cooked, water-soaked vegetables very generally cause digestive disturbances, which are often serious. Nearly every vegetable may be cooked so that with plain bread it may form a palatable course by itself, if it is desired to serve it in this manner.

All green vegetables, roots, and tubers should be crisp and firm when put on to cook. If for any reason a vegetable has lost its firmness and crispness, it should be soaked in very cold water until it becomes plump and crisp. With new vegetables this will be only a matter of minutes, while old roots and tubers often require many hours. All vegetables should be thoroughly cleaned just before being put on to cook. Vegetables that form in heads, such as cabbage, cauliflower, and Brussels sprouts, should be soaked, heads turned down, in salted cold water, to which a few spoonfuls of vinegar may be added. If there are any worms or other forms of animal life in these vegetables, they will crawl out. To secure the best results all vegetables except the dried legumes must be put in boiling water, and the water must be made to boil again as soon as possible after the vegetables have been added, and must be

kept boiling until the cooking is finished. Herbaceous vegetables should boil rapidly all the time. With tubers, roots, cauliflower, etc., the ebullition should not be so violent as to break the vegetables. Green beans and peas when removed from the pod must also be soaked gently, i. e., just simmer. When the pods and all are used they are to be cooked rapidly, like the herbaceous vegetables.

To secure the most appetizing and palatable dishes, only fresh tender vegetables should be cooked. If, however, green beans, peas, etc., have grown until a little too old and it still seems best to gather them, a very small piece of baking soda added to the water in which they are boiled makes them more tender, it is commonly believed, and helps to retain the color. Too much soda injures the flavor, and an excess must be carefully avoided. A little soda may also be used to advantage if the water is quite hard. Peas may be boiled for fifteen or twenty minutes in the water to which the soda has been added, then to be cooked the same as peas with pork.

During the cooking of all vegetables the cover must be drawn to one side of the steppan to allow the volatile bodies liberated by the heat to pass off in the steam. All vegetables should be thoroughly cooked, but the cooking should stop while the vegetable is still firm. This, of course, does not apply to vegetables that are cooked in soups, purees (thick strained soups), etc. The best seasoning for most vegetables is salt and good butter. Vegetables that are blanched and then cooked with butter and other seasonings and very little moisture are more savory and nutritious than when all the cooking is done in a good deal of clear water.

LOSSES IN COOKING VEGETABLES

In baking vegetables there is little loss of material except the water which is driven off by the heat. When vegetables are immersed in water, as in boiling, a greater or less loss of material is almost inevitable, the kind and amount of material extracted by the water depending upon such factors as the sort of water used, its temperature at the beginning and during the cooking period, the length of time the cooking is continued, and the condition of the vegetable, that is, whether pared, whole, or cut into small pieces.

In experiments carried on under the auspices of the Office of Experiment Stations it was found that when potatoes were boiled in the jackets the loss of material was very trifling. When peeled and soaked for several hours before boiling, the loss in round numbers amounted to about 50 per cent of the nitrogenous material, and 40 per cent of the mineral matter present. When potatoes were peeled and placed at once in boiling water, only about 8 per cent of the proteid matter and 19 per cent of the mineral matter present were extracted by the water. Little starch was removed from the potatoes by the solvent action of water, but when peeled potatoes were boiled the amount of starch removed by ab-

raison was considerable, at times nearly 30 per cent of the total value of the potato.

In the experiments with carrots it was found that the loss was greatest when the roots were cut into small pieces, amounting in this case to nearly 30 per cent of the total food material present. The sugar extracted when the carrots were boiled was equivalent to nearly a pound to the bushel. When cabbage was boiled the amount of material extracted was found to be considerable, amounting to about one-third of the total food material present, the chief constituents extracted by the water being ash or mineral matter. Some recent German experiments have shown that when vegetables are steamed only one-third as much material is removed as when they are boiled.

In all cases the loss in cooking vegetables is not great enough to seriously influence the method of cooking selected in the ordinary family. But in institutions where, owing to small funds, every effort must be made to obtain the most nutritious diet from the available food supply, it is only fair to say that of two equally palatable methods of cooking vegetables that should be selected which entails the smallest loss.

CHANGES THAT TAKE PLACE IN COOKING

Briefly, these are the principal changes that take place in vegetables during cooking: The cellular tissue is softened and loosened; the nitrogenous substances are coagulated; the

starch granules absorb moisture, swell, and burst; and flavors and odors are developed.

As long as the vegetable is kept at a temperature above 125° F. changes continue to go

in the vegetable substance. The most marked of these are in the starch and in the odor, color, and flavor of the vegetable. Starch will not dissolve in cold water, but pure starch gelatinizes readily in hot water, and if the temperature is high enough will become gummy and opaque. If starch is cooked in just moisture enough to swell and burst its granules and is then kept hot, but without additional moisture, a change will continue to take place, though the starch will remain dry and glistening. The flavor grows sweeter and more nutty the longer the starchy food cooks in dry heat. (See Boiled potatoes.) It is only vegetables that are composed largely of starch that can be kept hot in this manner without acquiring a strong taste and poor color. Potatoes, if kept in a closely covered vessel or with the unbroken skins on, will become soggy and dark and have a rank flavor. This is owing to the retention of moisture, which changes some of the starch to a sticky

gummy mass, and very probably to the noxious volatile bodies which are generated by heat and should be allowed to pass away. If the skins are broken and the vessel ventilated, potatoes may be kept warm a long time without spoiling.

Many experiments which the writer has made have shown that foods which are well ventilated during cooking are better flavored than those which are closely covered. Experiments have also convinced the writer that thoroughly ventilated foods are more wholesome than those that are not. Hence the urgent necessity for thorough ventilation while cooking vegetables or any other foods.

Overcooking changes and toughens the texture of vegetable foods and destroys the chlorophyll and other coloring matters and volatilizes or injures the bodies which contribute to the flavor. Overcooked vegetables are inferior in appearance and flavor and often indigestible (that is, promotive of digestive disturbance) as well as unpalatable.

RECIPES FOR COOKING

ASPARAGUS

This delicious spring vegetable should be treated very simply, yet carefully.

Cut off the woody part, scrape the lower part of the stalks. Wash well and tie in bunches. Put into a deep stewpan, with the cut end resting on the bottom of the stewpan. Pour in boiling water to come up to the tender heads, but not to cover them. Add a teaspoonful of salt for each quart of water. Place where the water will boil. Cook until tender, having the cover partially off the stewpan. This will be from fifteen to thirty minutes, depending upon the freshness and tenderness of the vegetable. Have some slices of well-toasted bread on a platter. Butter them slightly. Arrange the cooked asparagus on the toast, season with butter and a little salt and serve at once. Save the water in which the asparagus was boiled to use in making vegetable soup.

Another method of cooking asparagus is to cut all the tender part into short pieces. Add boiling water enough to just cover the vegetable and place where the water will boil. Cook until tender (about fifteen minutes), season with salt and butter, and serve in the greater part of the juice.

If preferred, a cream dressing may be served with asparagus.

GLOBE ARTICHOKE

The large flower bud of the *Cynara scolymus* is known as the globe or French artichoke. The flower buds must be used before they open. The edible portion consists of the thickened portion of the base of the scales and the receptacle to which the leaf-like scales are attached. In cookery books the receptacles are always spoken of as the bottoms. The parts of the flower in the center of the bud are called the "choke" and must always be removed.

When the artichoke is very young and tender the edible parts may be eaten raw as a salad. When it becomes hard, as it does very quickly, it must be cooked. When boiled it may be eaten as a salad or with a sauce. The scales are pulled with the fingers from the cooked head, the base of each leaf dipped in the sauce and then eaten. The bottoms (receptacles), which many consider the most delicate part of the artichoke, may be cut up and served as a salad, or they may be stewed and served with a sauce. To prepare the artichoke remove all the hard outer leaves. Cut off the stem close to the leaves. Cut off the top of the bud. Drop the artichokes into boiling water and

cook until tender, which will take from thirty to fifty minutes, then take up and remove the choke. Serve a dish of French salad dressing with the artichokes, which may be eaten either hot or cold. Melted butter also makes a delicious sauce for the artichoke if they are eaten hot.

JERUSALEM ARTICHOKE

This vegetable is in season in the fall and spring, and may be cooked like kohlrabi and served in a white cream or sauce. The artichoke may also be cooked in milk.

When this is done, cut the washed and peeled artichoke into cubes, put in a stewpan, and cover with milk (a generous pint to a quart of cubes). Add one small onion and cook twenty minutes. Beat together one tablespoonful of butter and one level tablespoonful of flour, and stir this into the boiling milk. Then season with a teaspoonful of salt and one-fourth of a teaspoonful of pepper, and continue the cooking half an hour longer. The cooking should be done in a double boiler. The artichoke also makes a very good soup.

BEETS

Beets are among our most useful vegetables, since they may be had all through the summer and may also be stored in good condition for winter use. Sometimes beets are cut in small pieces, after boiling, and served with white sauce, but the most common as well as the most palatable way of serving them is with butter.

Beets With Butter.

Wash the beets, being careful not to break the skin. Put into a stewpan and cover generously with boiling water and boil until tender. Young beets will cook in one hour. As the beets grow old the time of cooking must be increased. In winter this vegetable becomes so hard it may require four or more hours of steady boiling to soften it. It is then only suitable for pickling in vinegar after being thoroughly boiled.

When the young beets are cooked, take them from the boiling water and drop them into cold water. Rub off the skin. Cut the beets in thin slices and season with salt and butter. Serve at once.

Beet Greens.

Beets are usually thickly sowed, and as the young beet plants begin to grow they must be thinned out. The young plants pulled from the bed make delicious greens, particularly if the root attained some little size. Unfortunately, of late years the leaves are attacked by

insects; therefore, they must be examined leaf by leaf, and all which are infested rejected. Do not separate the roots from the leaves. Wash thoroughly in many waters. Put into a stewpan and cover generously with boiling water. Add a teaspoonful of salt for every two quarts of greens. Boil rapidly until tender. This will be about thirty minutes. Drain off the water, chop rather coarse, season with butter and salt.

The vegetable may be boiled with pork as directed for "Cabbage and Pork."

BROCCOLI

This vegetable is a species of cauliflower and can be cooked and served in the same manner.

BRUSSELS SPROUTS

This is a species of cabbage, which forms in many small heads about the size of an English walnut on the stock of the plant. It is fairly common in most large markets and is worthy of more extended use than it has commonly met with in the United States.

Brussel Sprouts Blanched.

Remove the wilted or yellow leaves from the little heads or "sprouts," cut the stock close to the head, and soak in salted cold water for an hour or more. Drain well and put into plenty of boiling salted water. Allow one teaspoonful of salt to two quarts of water. Boil rapidly for fifteen or twenty minutes, the time depending on the size of the heads. When done turn into a colander and pour cold water over the heads. They are now ready to cook in butter, or to serve with any kind of sauce. Or the boiling water may be drained from the sprouts, which can then be seasoned with butter, salt, and pepper.

Brussels Sprouts Saute.

1 quart Brussels sprouts.
3 tablespoonfuls butter.
 $\frac{1}{2}$ teaspoonful salt.
 $\frac{1}{4}$ teaspoonful pepper.
To sauteur a food is to cook it quickly in a frying pan in a little fat. Blanch the sprouts and drain well. Put them into a broad-bottomed saucepan with the butter and other seasonings. Place over a hot fire and shake frequently. Cook five minutes. Serve hot.

BEANS

Beans are served as a vegetable in three stages of growth, namely, the tender young pods, the fresh seeds, and the dried seeds. The pods are known as green or string beans and as butter beans, depending upon the variety. String beans make one of four most delicious vegetables, if young and properly cooked. They should be gathered before the seeds begin to form. In this state the bean is sweet, delicate, and tender, but not a highly nutritious food.

Green or String Beans.

Formerly it was difficult to find the slender, stringless green beans, but to-day the progressive market gardeners make a point of raising beans of this kind. Unfortunately, not all market gardeners and farmers are progressive, and many still raise a coarse, fibrous bean that is a disappointment to the consumer. In the very early stage of the pod almost any kind of bean will be good, if properly cooked, but all except the stringless kind must have their strings carefully removed. The pods should be gathered while small and tender. If for any reason they become wilted, they must be made crisp and fresh by being soaked in cold water. The beans that are brought from the South in cold weather are usually more or less wilted. They should be freed from strings, cut up, and soaked at least twelve hours in cold water. They will then cook like fresh beans.

Butter beans, the varieties of string beans which are pale yellow in color, may be cooked like the green string beans.

To Blanch Green Beans.

Green beans should always be blanched. To do this drain them from the cold water and put them into water that is boiling rapidly, allowing a teaspoonful of salt to two quarts of water. Boil rapidly, with the cover partially off the saucepan, for twenty minutes. Turn into a colander and let cold water run upon them. They are now ready to be finished in any manner you like. The blanching can be done in the morning while the fire is good and the beans be finished for dinner at the proper time.

Green Lima Beans.

Cover 1 quart of the shelled beans with boiling water. Place on the fire where they will boil up quickly, then draw back where they will just simmer until done. When tender pour off a part of the water. Season the beans with a teaspoonful of salt and 2 heaping tablespoonfuls of butter.

Or drain the water from the beans. Put the butter in a saucepan with 1 tablespoonful of flour. Stir over the fire until smooth and frothy, then add the beans and stir over the fire for five minutes. Draw back and add half a pint of water, meat stock, or milk. Simmer ten minutes. If liked, a teaspoonful of fine herbs may be added a few minutes before serving. It will take from forty-five to sixty minutes to boil the beans sufficiently.

Green Beans, Plain.

1 quart beans.
 $\frac{1}{2}$ pint water.
1 generous tablespoonful butter.
1 level teaspoonful salt.

String the beans if necessary and cut them into two-inch lengths. Blanch them as directed. Drain and put in the saucepan with the water, salt, and butter. Cook for ten minutes over a hot fire, turning the contents of the saucepan from time to time. Serve very hot. If the beans are not tender it may take fifteen minutes to cook them, but under all circumstances be careful not to overcook, as this ruins the flavor. If overcooked, green beans become yellow or brown.

Green Beans Boiled with Pork.

Boil about a quarter of a pound of pork for five hours. Have the beans free from strings and cut about 2 inches long. Cook them with the pork until tender (about half an hour).

Scarlet Runner Beans.

In Great Britain the scarlet runner beans, which are raised in the United States almost exclusively as an ornamental plant, are highly prized for the table. The tender green pods are "whittled" into small sections (after stringing) and cooked in water until just tender. Like other green vegetables, they lose their color and delicate flavor if overcooked. These beans are at their best seasoned only with butter and salt.

Puree of Dried Beans

Cook 1 quart of beans in water until very soft, then drain well (saving the water) and rub through a puree sieve. Put 1 pint of the strained beans in a stewpan with 2 tablespoonfuls of butter or savory drippings, 1 teaspoonful of pepper, and hot milk enough to make the puree like thick mush. About half a pint of milk will be right. Cook in the double boiler for one hour, stirring often and adding more milk if too dry. Heap the puree in the center of a hot platter. Garnish with a circle of fried sausages, pork chops, mutton chops, or any fat meat. The puree may be served as a vegetable, with any kind of meat.

A soup may be made with the water in which the beans were cooked and the remainder of the strained beans.

CABBAGE

Because of the relatively large amount of sulphur which cabbage contains it is apt to be indigestible and cause flatulence when it is improperly cooked. On the other hand, it can be cooked so that it will be delicate and digestible. The quickest and simplest methods of cooking cabbage are the best. The essentials for the proper cooking of this vegetable are plenty of boiling water, a hot fire to keep the water boiling all the time, and thorough ventilation, that the strong-smelling gases, liberated by the high temperature, may be carried off in the steam.

The vegetable when done should be crisp and tender, any green portion should retain the color, and the white portion should be white and not yellow or brown.

To Boil Cabbage.

Cut a small head of cabbage into four parts, cutting down through the stock. Soak for half an hour in a pan of cold water to which has been added a tablespoonful of salt; this is to draw out any insects that may be hidden in the leaves. Take from the water and cut into slices. Have a large stewpan half full of boiling water; put in the cabbage, pushing it under the water with a spoon. Add one tablespoonful of salt and cook from twenty-five to forty-five minutes, depending upon the age of the cabbage. Turn into a colander and drain for about two minutes. Put in a chopping bowl and mince. Season with butter, pepper, and more salt if it requires it. Allow a tablespoonful of butter to a generous pint of the cooked vegetable. Cabbage cooked in this manner will be of delicate flavor and may be generally eaten without distress. Have the kitchen windows open at the top while the cabbage is boiling, and there will be little if any odor of cabbage in the house.

Cabbage Cooked With Pork.

For a small head of cabbage use about half a pound of mixed salt pork. Boil the pork gently for three or four hours. Prepare the cabbage as for plain boiled cabbage. Drain well and put on to boil with the pork. Boil rapidly for twenty-five to forty-five minutes. Serve the pork with the cabbage. The vegetable may require a little more salt.

Smoked bacon or ham may be substituted for the pork. Cabbage may be cooked in water in which corned beef was boiled.

Creamed Cabbage

- 1 pint boiled and minced cabbage
- $\frac{1}{2}$ pint hot milk
- 1 tablespoonful butter
- 1 teaspoonful flour
- $\frac{1}{2}$ teaspoonful salt
- $\frac{1}{2}$ teaspoonful pepper

Put the cabbage, hot milk, salt and pepper in a stewpan and on the fire. Beat the butter and flour together until creamy, then stir into the contents of the stewpan. Simmer ten minutes, being careful not to scorch the sauce; serve very hot.

CAULIFLOWER

This vegetable, which a few years ago was a luxury, is now cultivated by nearly all market gardeners, and is within the means of all housekeepers. It is a most delicious vegetable, when properly cooked, and vile when improperly cooked, which generally means when overcooked.

Remove all the large green leaves and the greater part of the stalk. Put the head down in a pan of cold water which contains to each quart a teaspoonful of salt and a tea-

spoonful of vinegar. Let it soak in this water an hour or more. This is to draw out worms, if any should be hidden in the vegetable. When ready to cook the cauliflower put it into a large stewpan, stem end down, and cover generously with boiling water. Add a tablespoonful of salt and cook with the cover of the saucepan partially off, boiling gently all the time. A large, compact head will require a full half hour, small heads from twenty to twenty-five minutes. If the flowers are loose the heat penetrates to all parts quickly. When compact a little extra time should be allowed for the cooking, but the time must never exceed the half hour. The cauliflower begins to deteriorate the moment it begins to be overcooked. Overcooking, which is very common, can be told by the strong flavor and dark color. It makes the vegetable not only unpleasant to the eye and palate, but indigestible also. If this vegetable must be kept warm for any length of time, cover the dish with a piece of cheese cloth. In hotels and restaurants it is better to blanch it, chill with cold water, and then heat in salted boiling water when needed.

Creamed Cauliflower

- 1 pint cooked cauliflower
- 1 pint milk
- 1 teaspoonful salt
- $\frac{1}{4}$ teaspoonful pepper
- 1 tablespoonful butter
- $\frac{1}{2}$ teaspoonful flour
- 3 slices toasted bread

Have the cooked cauliflower broken into branches and seasoned with half the salt and pepper. Put the butter in a saucepan and on the fire. When hot add the flour and stir until smooth and frothy, then gradually add the milk, stirring all the time. When the sauce boils add the salt, pepper, and the cauliflower. Cook 10 minutes and dish on the slices of toast. Serve very hot.

CARROTS

The carrot is valuable as a vegetable and as a flavorer. When partially grown and fresh from the ground they have a delicious flavor, and are so tender that they may be cooked without water. As the carrot grows old the flavor grows stronger, and in the majority of varieties the heart grows hard and woody. When the carrot reaches this stage only the outer layers are desirable for food.

Carrots With White Sauce

Scrape the carrots lightly; then cut into large dice or slices. Put into a stewpan with salted boiling water, allowing a teaspoonful of salt for a quart of water, and boil until tender. The young carrots will cook in thirty minutes and the old ones in forty-five. Drain, season with a little salt, put them in a vegetable dish, and pour the white sauce over them. Or the carrots may be cut into dice before cooking and boiled and drained as directed; then put them back in the stewpan, and for every pint add one tablespoonful of butter, one teaspoonful of sugar, half a teaspoonful of salt, and one gill of water or meat stock. Cook over a hot fire until the carrots have absorbed the seasonings and liquid.

CELERY

The culture of this vegetable is so general that one can find it in large markets nearly every month of the year. Celery is at its best in the late fall and early winter, when the weather has been cold enough to crisp the blanched stalks. This plant is most useful as a salad and flavorer, but is perhaps most commonly eaten raw, without any dressing except salt, as an accompaniment of fish, meat, etc.

Only the tender inner stalks should be eaten raw. The hard, outside stalks make a delicious and wholesome dish when properly cooked. When thus used, celery should be blanched and served with a sauce.

Stewed Celery

To blanch celery in cooking, remove all the leaves from the stalks. Scrape off all rusted or dark spots, cut into pieces about 3 inches long, and put in cold water. Have a stewpan of boiling water on the fire, wash and drain the celery and put in the boiling water. Add one teaspoonful of salt for every 2 quarts of water. Boil rapidly for fifteen minutes, having the cover partially off the stewpan. Pour off the water and rinse with cold water, then drain. The celery is now ready to finish in the following manner: Put the celery in the stewpan with one tablespoonful of butter, and one teaspoonful of salt for each quart of celery. Cover and cook slowly for fifteen minutes. Shake the pan frequently while the celery is cooking. Serve hot.

CELERIAC

This vegetable is also known as "knot celery" and "turnip-rooted celery." The roots, which are about the size of a white turnip, and not the stalks are eaten. They are more often used as a vegetable than as a salad.

Pare the celeriac, cut in thin, narrow slices and put into cold water. Drain from this water and drop into boiling water and boil thirty minutes. Drain and rinse with cold water. The celeriac is now ready to be prepared and served the same as celery.

Puree of Celeriac

- 1 quart celeriac cut in dice
- 2 tablespoonfuls butter
- 1 tablespoonful flour
- 1 teaspoonful salt
- 1 gill stock or cream

Cook the celeriac thirty minutes in boiling water, rinse in cold water, then press through a puree sieve. Put the butter in a saucepan and on the fire. When hot add the flour and stir until smooth and frothy, and then add the strained celeriac and cook five minutes longer. If the puree seems dry, add more stock or cream. The vegetable varies as to the amount of moisture it requires. It should be eaten very. If used as a garnish it is generally put in the center of the dish and the poultry or meat placed on it or around it. Otherwise it may be served on toast or fried bread as a dish by itself.

GREEN CORN

Green corn, a typical American food product, is a vegetable which, for most palates, is easily spoiled by overcooking, since the longer the cooking period the less pronounced the delicate corn flavor.

Boiled Corn on the Cob

The most satisfactory way to serve green corn is on the cob. Free the corn from husks and "silk." Have a kettle of water boiling hard, drop the corn into the water and cook ten minutes. If only a few ears of corn are put in a kettle of boiling water, the temperature of the water is not lowered greatly and the corn will cook in eight minutes. On the other hand, if a large quantity of corn is crowded into a kettle of boiling water, the temperature is very much lowered and the time of cooking must be increased. When possible, surround the corn with a generous quantity of boiling water.

CUCUMBERS

The cucumber is much oftener eaten in the United States as a salad than cooked, yet it is a very palatable vegetable when stewed

and served with a white sauce, or seasoned with butter, salt and pepper, and served on toast. The pared and quartered cucumber should be cooked until tender in boiling salted water, which will require about fifteen minutes, and then served as directed. Cucumbers may also be cut in slices lengthwise and fried like summer squash or eggplant.

Stewed Cucumbers

Stew pared cucumbers, cut in quarters or in thick slices, for fifteen minutes in a saucepan with a little water and a minced shallot or a small minced onion. Pour off the water; stir in a little flour, butter, and salt; heat for two or three minutes, and then serve.

Cucumber Sauté

Boil pared and quartered cucumbers for three minutes only. Then drain the pieces and season with salt and pepper. Roll in flour and cook in a saucepan with butter for twenty minutes. This dish may be varied by adding minced parsley, chives, and chervil about five minutes before the cooking is finished.

EGGPLANT

This vegetable, as well as potato and tomato, belongs to the nightshade family. Like all succulent green vegetables, it has little nutritive value. The common methods of cooking are by frying, broiling, and baking.

Baked Eggplant

For baked eggplant make a dressing as for stuffed peppers, except that a little more salt, pepper, and butter are used. Cut the eggplant in two lengthwise, scrape out the inside, and mash it fine, then mix with the dressing and return to the shells. Place on a pan and in the oven. Cook forty-five minutes.

Fried Eggplant

For fried eggplant cut the vegetable in slices about half an inch thick and pare. Sprinkle the slices with salt and pile them upon one another, put a plate with a weight on top of the slices. Let them rest for an hour then remove weight and plate. Add one tablespoonful of water, half a tablespoonful of salt, and half a teaspoonful of pepper to an egg. Beat well. Dip the slices of eggplant in the egg, then in dried bread crumbs. Spread on a dish for twenty or more minutes. Fry till brown (in deep fat).

Broiled Eggplant

The eggplant is sliced and drained as directed above. Then spread the slices on a dish, season with pepper, and baste with salad oil, sprinkle with dried bread crumbs and broil.

KALE, OR BORECOLE

There are several varieties of this vegetable. The dwarf, green-curled kale is the best for the table and is a fall and spring vegetable. The leaves are sweeter and more tender after having been touched by the frost. In the North the roots may be banked with earth at the beginning of winter and when extreme cold weather sets in the plants may be covered lightly with hay or straw. In the spring the old stalks will produce young shoots that make delicious greens.

Kale Boiled With Pork

Cook the kale the same as cabbage with pork.

Minced Kale

Remove all the old or tough leaves. Wash the kale thoroughly and drain, then put on to cook in a kettle of boiling water, to which has been added salt in the proportion of 1 tablespoonful to 4 quarts of water. Boil rapidly, with the cover off the kettle, until the vegetable is tender. Pour off the water, and chop the kale rather fine; then put back into

the kettle and add 1 tablespoonful of butter and 2 of meat broth or water for each pint of the minced vegetable. Add more salt if required. Cook for ten minutes and serve at once. The time required for cooking kale varies from thirty to fifty minutes. If young and fresh from the garden it will cook in thirty minutes.

KOHL-RABI, OR TURNIP CABBAGE

This vegetable is a variety of the cabbage, but instead of the reserve nutritive matter of the plant being stored largely in the leaves or flowers, it is collected in the stem, which forms a turnip-like enlargement just above the ground. Kohl-rabi is fine flavored and delicate, if cooked when very young and tender. It should be used when it has a diameter of not more than 2 or 3 inches. As it grows large it becomes tough and fibrous.

Boiled Kohl-Rabi

Wash and pare the vegetables, then cut in thin slices. Put into slightly salted boiling water and boil, with the cover partially off the stewpan, until the vegetable is tender. This will take from thirty to fifty minutes. Pour off the water and season with butter, salt and pepper.

Kohl-rabi may be boiled with pork in the same way as cabbage (see page 20).

The cold boiled vegetable may be served as a salad.

LENTILS

Lentils may be cooked in purees, soups, etc., like dried beans.

Baked Lentils

- 1 quart lentils
- 1 quart water
- 6 ounces mixed salt pork
- 1 clove of garlic or 1 small onion
- 1 generous teaspoonful salt
- $\frac{1}{2}$ teaspoonful pepper

Pick over and wash the lentils. Soak in cold water overnight. In the morning pour off the water and put the lentils in a stewpan with two quarts of cold water and place on the fire. As soon as the water begins to boil the lentils will rise to the top. Take them off with a skimmer and put them in a deep earthen dish, with the pork and onion in the center. Mix the pepper and salt with a quart of boiling water and add. Put the dish in a moderate oven, and cook slowly for four or five hours. The lentils must be kept moist, and it may be necessary to add a little water from time to time. If the pork is not very salt the dish may require a little more salt.

Stewed lentils are prepared in about the same manner, but using more water. Instead of pork, fat corned beef or the shank of a ham may be employed.

LETTUCE

If lettuce has grown until rather too old for salad, it may be cooked, and makes a fairly palatable dish.

Boiled Lettuce

Wash four or five heads of lettuce, carefully removing thick, bitter stalks and retaining all sound leaves. Cook in plenty of boiling salted water for ten or fifteen minutes, then blanch in cold water for a minute or two. Drain, chop lightly, and heat in a stewpan with some butter, and salt and pepper to taste. If preferred, the chopped lettuce may be heated with a pint of white sauce seasoned with salt, pepper, and grated nutmeg. After simmering for a few minutes in the sauce, draw to a cooler part of the range and stir in the well-beaten yolks of two eggs. See also, "Peas with lettuce."

ONION

This vegetable is the most useful of all our

flavorers, and there is hardly a soup, stew, sauce, etc., that is not improved by the addition of the onion flavor. As a vegetable the onion may be prepared in a variety of ways. The white onions are the most delicate and are therefore more suitable as a vegetable than the yellow or red variety. The large Spanish onions and the Bermuda onion are also delicate and suitable for a table vegetable. If the stronger onions are used for this purpose they must be thoroughly blanched.

Boiled Onions in White Sauce

Peel the onions and cut off the roots, dropping into cold water as fast as they are peeled. Drain from the cold water and put in a stewpan with boiling water to cover generously. Add a teaspoonful of salt for each quart of water. Boil rapidly for ten minutes, with the cover partially off the saucepan. Drain off the water and cover the onion with hot sweet milk (a quart of onions will require a pint of milk). Simmer for half an hour. Beat together one tablespoonful of butter and one level teaspoonful of flour. Add one teaspoonful of salt and one-fourth of a teaspoonful of white pepper. Gradually beat in about half a cupful of milk in which the onions are cooking. When smooth, stir the mixture into the onions and milk. Let the dish cook ten minutes longer and serve.

Stewed Onions

Cut the onions in slices and boil in salted water for ten minutes. Drain well and return to the stewpan.

For a quart and a half of onion, measured before it was boiled, add two tablespoonfuls of butter, one teaspoonful of salt, and one-fourth of a teaspoonful of pepper. Cover the stewpan and cook over a hot fire for five minutes, shaking the pan to prevent the onion from browning. Set the stewpan back where the contents will cook slowly for forty minutes. Drippings may be substituted for the butter, but, of course, the dish will not be so delicate in flavor.

OKRA

Though okra, a variety of Hibiscus with mucilaginous edible pods, will grow in most parts of the United States, it is much more commonly eaten in the southern states than elsewhere. The young pods should be boiled in salted water until tender (about twenty minutes), drained, and heated for 5 minutes with cream (a scant cup to a quart of okra), a tablespoonful of butter, and salt and pepper. Okra is also a common ingredient of soups. (See p. —.)

The cultivation of okra, methods of serving it, and related topics are discussed in a recent publication of the Department of Agriculture.

GREEN PEPPERS

The sweet green pepper, though fairly common in our city markets, is not as widely known as a vegetable as it deserves. Sliced, it makes a very fine salad alone, or, more commonly, mixed with other salad plants like lettuce. Stuffed and baked peppers are very palatable.

Green Peppers Stuffed and Baked

Use only tender sweet peppers. For six medium-sized peppers make a dressing in the following manner: Soak, in cold water, enough stale bread to make one pint when the water is pressed out. Season this with two teaspoonfuls of salt, one tablespoonful of fine herbs, about one-fifth of a teaspoonful each of sweet basil and summer savory, and two tablespoonfuls of butter or savory drippings.

Cut off the stem end of the pepper and remove all the interior, being careful to take out every seed. Fill the peppers with the

dressing. Place them on end in a shallow baking dish and pour around them a sauce prepared as follows: Put into a saucepan and on the fire, one tablespoonful of drippings. When hot, add one level tablespoonful of flour. Stir until smooth and brown, then add, gradually three gills of meat stock or water. Season with one level teaspoonful of salt. Cook five minutes, then pour around the stuffed peppers. Put the dish in a moderately hot oven and bake the peppers one hour, basting often with the sauce in the dish. Peppers may also be filled with a well-seasoned dressing of chopped meat, made with or without the addition of bread crumbs or rice.

GREEN PEAS

This vegetable should be gathered when the seeds are about half grown, and it should be cooked as soon as possible after gathering. When the peas are thus young and tender they are best simply boiled and seasoned with salt and good butter. Some varieties of peas lack sweetness, and in this case a little sugar in the water in which they are cooked improves the flavor. Overcooking spoils the color and flavor of the vegetable. Peas should always be boiled slowly, and with the cover partially off the stewpan. It is impossible to give the exact time of cooking this vegetable, since so much depends upon the maturity of the peas, the length of time they have been picked, etc. Young, tender peas will generally cook in twenty or thirty minutes, and the seasoning should be added while they are still firm and crisp. If the peas are cooked until the green color of the chlorophyll is destroyed they are overdone and their delicate flavor is spoiled. When peas are overgrown and a little hard they should be cooked by the rule "Peas with pork." When this rule is followed a pinch of delicate, small, white onions may be added to the peas and other ingredients and will give a very savory dish.

Boiled Peas With Butter

Put one quart of shelled peas in a stewpan and add enough boiling water to cover them generously. Place over a hot fire and when they begin to boil draw back where the water will bubble gently. Until the peas are done cook with the cover partially off the stewpan. When the peas are tender add one teaspoonful of salt and three tablespoonfuls of good butter. Cook ten minutes longer. If the peas are not the sweet kind add a teaspoonful of sugar with the salt and butter.

Peas With Pork

1 quart peas
4 ounces pork
1 tablespoonful butter
1 gill water ($\frac{1}{2}$ cup)
2 small white onions
 $\frac{1}{2}$ teaspoonful pepper
Cut pork into small bits. Put butter into stewpan and on the fire. When the butter is melted add the pork and cook gently until a light brown, then add the water, peas, onion and pepper. This is a good way to cook peas when they are a little old and hard.

Peas With Lettuce

1 quart peas
2 tablespoonfuls butter
1 head lettuce—the heart
1 small onion
1 teaspoonful sugar
 $\frac{1}{2}$ gill water
Put all the ingredients into a stewpan, cover and place over the fire and cook for five minutes, tossing the vegetables several times. Now draw the pan back where the contents will simmer slowly for half an hour.

Puree of Dried or Split Peas

Soak one quart of dried peas over night and follow the directions for puree of dried beans.

SUGAR PEAS

The greed pods of the sugar pea may be prepared like string beans.

Gather the pods while the seeds are still very small. String them like beans and cut into two or three lengths. Cover with boiling water and boil gently until tender. If they are young and fresh they will cook in twenty-five or thirty minutes. Pour off some of the water, which will serve for soup. Season with salt and butter and serve at once. When the pods are fresh and tender they have an exquisite flavor. When the seeds have grown large and the pods become tough they may be shelled and cooked like any other variety of peas. The seeds of the sugar pea are tender and fine flavored.

BOILED POTATOES

The method and time given for boiling potatoes are the same whether the potato be peeled, partially peeled, or left with the skin intact. If a dozen or two ordinary sized potatoes are put on the fire in a large stewpan and are covered generously with boiling water and a cover is immediately put on the stewpan, they will be cooked to the proper point in thirty minutes from the time the cover was put on the stewpan. Small potatoes will cook in two minutes less time, and very large potatoes will require about thirty-five minutes cooking. If the potatoes are to be boiled in their skins, wash them until clean and then with a sharp knife cut a narrow band of the skin from the center of the potato. Cut a little bit of the skin from each end of the potato. If the potatoes are to be peeled, use a very sharp knife and remove the thinnest possible layer. The skins may be scraped off, if preferred, and there are special knives for this purpose. Let the potatoes boil fifteen minutes, then add 1 tablespoonful of salt for every dozen potatoes. When the potatoes have been cooking thirty minutes, drain off every drop of water and let all the steam pass off. They are now ready to serve, though they will not be injured but in fact will be improved by being kept hot for an hour or more, if they are well ventilated in such a way that they dry rather than retain moisture.

When boiled or steamed potatoes must be kept warm for any length of time, place the stewpan on the range on a tripod or iron ring and cover the potatoes with one thickness of cheese cloth. This will protect them from the cold air and allow the moisture to pass off.

Steamed Potatoes

Steamed potatoes are prepared as for boiling, put in a closed vessel having a perforated bottom, which is then put over a kettle of boiling water. The water must be kept boiling hard every moment. They will require from thirty to forty minutes to cook.

Escalloped Potatoes

This dish may be prepared by mixing a pint and a half of cold potatoes cut in cubes and seasoned with a teaspoonful of salt, one-fourth of a teaspoonful of pepper, and a pint of cream sauce. Put the mixture in a shallow baking dish, cover with grated bread crumbs, and dot with butter. Bake half an hour in a moderate oven.

Baked Potatoes

Select potatoes having a smooth, unmarred surface. Wash perfectly clean and let them drain. Put them in an old baking pan kept

for this purpose—do not crowd them—and put in a hot oven. If the oven is large and hot and the potatoes of medium size, forty minutes will answer for the cooking. On the other hand, if the oven is filled with cold potatoes the temperature of the oven will be reduced quickly and it will require an hour to cook the potatoes. Baked potatoes should be served as soon as they are done. If they must be kept any time after the cooking is completed, break them in order that the moisture may escape. Keep them in a warm oven or covered with cheese cloth in a stewpan.

PARSNIPS

The vegetable, because of its pronounced taste, is probably not so generally liked as are most of the other roots. It is at its best in the early spring, when it has been in the ground all winter.

The simplest method of cooking the parsnip is to wash it clean, boil it, and then scrape off the skin. Now cut in slices and put in the vegetable dish. Season with salt and butter. When the parsnips are tender and just out of the ground they will cook in thirty-five minutes; when old it takes from forty to fifty minutes to cook them. The cooked and peeled parsnips may be chopped rather coarse, seasoned with salt, and put into a stewpan with hot milk enough to cover them. Place the stewpan on the range where the heat is moderate.

For a pint and a half of parsnips beat together one tablespoonful of butter and one teaspoonful of flour. Stir into the parsnips and milk. Simmer for ten minutes. Parsnips are often cut in slices after boiling and fried in butter.

SALSIFY

This vegetable is sometimes called oyster plant, because the flavor suggests that of the oyster, particularly when the boiled vegetable is sliced and fried in butter. Salsify is one of the roots that may be left in the ground over winter, thus making this vegetable available for the late summer, fall and spring.

To prevent this root from turning dark it must be dropped as soon as it is pared and cut into a mixture of flour and water made slightly acid with vinegar. For 6 good-sized roots mix together 1 tablespoonful of vinegar, 2 tablespoons of flour, 1 teaspoonful of salt, and 3 pints of water. Wash and scrape the roots, then cut into slices about 3 inches long. Drop into the prepared water. Place the stewpan on the fire and cook the salsify thirty minutes, counting from the time it begins to boil. Drain and serve in a white sauce. Or mix together one tablespoonful of butter half a teaspoonful of salt, one teaspoonful of lemon juice, 1 teaspoonful of minced parsley or chervil. Add this to the drained salsify and serve at once.

SPINACH

This vegetable is a great resource in cold weather when green vegetables are scarce.

The common spinach, which is the sort usually met with in gardens or markets, goes to seed quickly in hot weather, but New Zealand spinach, which is a very different plant from ordinary spinach and far less well known in the United States, yields tender greens all summer. The shoots should be cut regularly; if not, the old shoots become tough and rank flavored.

Spinach has little food value, but its refreshing and slightly laxative qualities make it a valuable adjunct to the more substantial foods. It contains little starch and only a suggestion of sugar, and is therefore one of the vegetables that physicians include in the bill of fare of many invalids who require a diet without these carbohydrates.

Like most other vegetables, it is rarely cooked to perfection, yet it is not difficult to prepare. Except for special reasons the simplest methods are the best for this vegetable. No matter how cheap the raw spinach may be, it is always expensive in two things—labor and butter. It takes a good of time, water and patience to wash it clean, and no other vegetable requires so much butter if it is to be at its best. Where strict economy must be practiced, sweet drippings from roast beef or chicken can be substituted for the butter.

To clean the spinach cut off the roots, break the leaves apart and drop them into a large pan of water, rinse them well in this water and put them in a second pan of water. Continue washing in clean waters until there is not a trace of sand on the bottom of the pan in which the vegetable was washed. If the spinach is at all wilted let it stand in cold water until it becomes fresh and crisp. Drain from this water and blanch. For half a peck of spinach have in a large saucepan 3 quarts of boiling water and 1 tablespoonful of salt. Put the drained spinach in the boiling water and let it boil ten minutes, counting from the time it begins to boil. When it begins to boil draw the cover of the saucepan a little to one side to allow the steam to escape. At the end of ten minutes pour the spinach into a colander, and when the hot water has passed off pour cold water over it. Let it drain well and mince coarse or fine, as is suitable for the manner in which it is to be served.

One peck of spinach will make about 1½ pints when blanched and minced.

Spinach With Cream

- ½ peck spinach
- 2 tablespoonfuls butter
- 1 tablespoonful flour.
- 1 teaspoonful salt
- 2 teaspoonful pepper
- ½ pint cream or milk

Blanch and mince the spinach. Put the butter in a sauce pan and on the fire. When hot add the flour and stir until smooth and frothy, then add the minced spinach and the salt and pepper. Cook for five minutes, then add the milk or cream, hot, and cook three minutes longer. Serve.

Spinach With Egg

- ½ peck spinach
- 3 tablespoonfuls butter
- 1½ teaspoonful pepper
- 2 eggs
- 3 teaspoonfuls salt

Wash and blanch the spinach, using two teaspoonfuls of the salt in the water in which the vegetable is boiled. Drain the blanched spinach and chop rather fine, return it to the saucepan, and add the salt, pepper and butter. Place on the fire and cook ten minutes. Heap in a mound on a hot dish and garnish with the hard-boiled eggs, cut in slices.

Spinach Cooked Without Water

Fresh spinach when washed holds enough water for cooking. Put the spinach in a stewpan and on the fire; cover and cook for ten minutes. Press down and turn the spinach over several times during the cooking. At the end of ten minutes turn the spinach over several times during the cooking. At the end of ten minutes turn the spinach into a chopping bowl, and mince rather fine. Return to the stewpan and add the seasonings, allowing for half a peck of spinach two generous tablespoonfuls of butter and a teaspoonful of salt. Simmer ten minutes; or if very tender five minutes will be sufficient.

Spinach cooked in this manner will retain all its salts. It will be more laxative and the flavor stronger than when blanched (boiled in water). In young tender spinach this is not objectionable, but when the overgrown vegetable is cooked in its own moisture the flavor is strong and somewhat acrid.

SWISS CHARDS

This vegetable is a variety of beet in which the leaf stalk and midrib have been developed instead of the root. It is cultivated like spinach, and the green, tender leaves are prepared exactly like this vegetable. The midribs of the full-grown leaves may be cooked like celery.

SQUASH

The various varieties of the summer squash are generally cooked when so small and tender that the thumb nail can pierce the rind easily.

To prepare for the table wash the squash, cut into small pieces, and either cook in boiling water or steam it. It will cook in boiling water in half an hour. It takes about an hour to cook it in the steamer. The cooked squash is mashed fine and seasoned with salt, pepper and butter. This method gives a delicate flavored but rather watery dish.

Summer squash is very palatable cut in slices and fried like eggplant.

It is claimed by many that the very young summer squashes, particularly the turban variety, or "cymlin" of the Southern States, are very delicate and palatable cooked whole. For this dish they should not be much larger than a silver dollar. In the opinion of the writer the crook-necked and other summer squashes are richer in flavor when grown to a large size. Cut the squash in small pieces and put in a stewpan with boiling water enough to cover. Boil for half an hour. Drain, mash, and season with salt, pepper and butter.

Cook winter squash in the same manner. Squash is one of the vegetables that require a good deal of butter.

TOMATOES

The tomato, although not very nutritious, may be classed as one of our most useful vegetables. Raw, it makes an attractive and refreshing salad and may be served by itself or in combination with other vegetables, with meat or with fish. As a vegetable the tomato may be prepared in many ways. It makes a good foundation for soups and sauces. Made into catsup or pickles it serves as a relish. The addition of a little tomato gives a pleasant, acid flavor to many soups and sauces, and also to meat, fish and vegetable dishes. If possible the tomatoes should ripen fully on the vines, as the flavor is much better than when picked green and then allowed to ripen.

When properly canned this vegetable keeps well and retains its natural flavor. The house-keeper who has a generous supply of canned tomatoes on hand will find them very valuable at all times of the year, but especially in the winter months when the variety of vegetables is not great.

Overcooking spoils the flavor and color of the tomato.

To Peel Tomatoes

Put the ripe tomatoes into a dish and pour boiling water over them. Let them rest in the water about one minute; then pour the water off. The thin skin will now peel off readily.

When a quantity of tomatoes are to be peeled have a deep stewpan a little more than half filled with boiling water and on the fire where the water will continue to boil. Put the tomatoes in a frying basket and lower into the boiling water. Let the basket remain one minute in the water. There must,

of course, be water enough to cover the tomatoes.

Stewed Tomatoes

Peel the tomatoes and cut into small pieces. Put into a stewpan and on the fire. Boil gently for twenty minutes or half an hour, counting from the time it begins to boil. Season five minutes before the cooking is finished. Allow for each quart of tomato one generous teaspoonful each of salt and sugar and one tablespoonful or more of butter.

Escalloped Tomatoes

1 pint peeled and cut tomatoes
1 pint grated bread crumbs
1 level teaspoonful salt
1 tablespoonful butter
A suggestion of pepper

Reserve three tablespoonfuls of the bread crumbs, and spread the remainder on a pan. Brown in the oven, being careful not to burn them. Mix the tomato, browned crumbs, salt, pepper, and half the butter together and put in a shallow baking dish. Spread the unbrowned crumbs on top, and dot with the remainder of the butter, cut into bits. Bake in a moderately hot oven for half an hour. The top of this dish should be brown and crisp.

Tomato Toast

Boil one quart of peeled and cut tomatoes for ten minutes, then rub through a strainer. Return to the stewpan and add two level teaspoonfuls of salt, half a teaspoonful of pepper, and two tablespoonfuls of butter. Place on the fire and cook five minutes. Have the bottom of a hot platter covered with well-toasted slices of bread and pour the hot tomato over it. Serve at once. A dropped or poached egg may be put on each slice of toast.

TURNIPS

This vegetable is generally spoiled by overcooking. The flat, white summer turnip, when sliced, will cook in thirty minutes. If the cooking is prolonged beyond this time the vegetable begins to deteriorate, growing dark in color and strong in flavor. The winter turnips require from forty-five to sixty minutes.

Boiled Turnips

Have the turnips peeled and sliced. Drop the slices into a stewpan with boiling water enough to cover generously. Cook until tender, then drain well. They are now ready to mash or chop. If they are to be served mashed, put them back in the stewpan; mash with a wooden vegetable masher, as metal is apt to impart an unpleasant taste. Season with salt, butter, and a little pepper. Serve at once.

Hashed Turnips

Chop the drained turnips into rather large pieces. Return to the stewpan, and for a pint and a half of turnips add a teaspoonful of salt, one-fourth of a teaspoonful of pepper, a tablespoonful of butter, and four tablespoonfuls of water. Cook over a very hot fire until the turnips have absorbed all the seasonings. Serve at once. Or the salt, pepper, butter and a tablespoonful of flour may be added to the hashed turnips; then the stewpan may be placed over the hot fire and shaken frequently to toss up the turnips. When the turnips have been cooking five minutes in this manner add half a pint of meat stock or of milk and cook ten minutes.

For information on Drying of Vegetables and Fruits at Home consult Farmers Bulletin 934.

For information on Preservation of Vegetables by Fermentation and Salting consult Farmers Bulletin 881.

For information on Home Storage of Vegetables consult Farmers Bulletin 879.

These will be sent free by the United States Department of Agriculture, Divisions of Publication, Washington, D. C.

THE FLOWER GARDEN

CULTURAL DIRECTIONS FOR FLOWERS

Some of the most satisfactory flowering annuals may be grown practically the same as garden vegetables, but others, although not difficult to grow, require different treatment. Most of the failures in growing flowering plants from seeds are on account of a lack of knowledge of the habits of the different plants. If the following directions are followed closely, success will be the rule.

Flowering plants are classed as annuals, biennials and perennials; and these are divided into three classes, hardy, half-hardy and tender.

Hardy Annuals are of the easiest culture, and among them are some of the most pleasing and satisfactory flowers. The seed may be sown outdoors in fall or early spring, either in a seed bed, to be transplanted, or in the bed where they are to remain during the summer. The plants will bloom the first season, and will then die. When the seed is sown in the fall the plants may not make much growth until spring, but will bloom much earlier than when sown in spring. They may be started indoors if desired.

Half-hardy Annuals will stand only slight frost. For early blooms the plants should be started in a greenhouse, hotbed or in boxes or pots in the house. The seed may be sown outdoors in seed beds, or in the beds where they are to remain, when the ground is warm and weather settled in spring. Most of them may be sown in fall and the plants wintered over in a cold frame.

Tender Annuals will not stand frost or cool weather, and the plants should not be set outdoors until late in spring.

Biennials live until the end of the second season, and then die. Some of them bloom the first season, the same as annuals, but most of them do not bloom until the second season.

Hardy Perennials seldom bloom the first year, but usually bloom the second and many succeeding years. The seed may be sown in spring, but is best sown in September.

Half-hardy Perennials require some protection during the winter. The seed may be sown outdoors late in spring; or the plants may be started in boxes or pots or wintered over in a cold frame.

Tender Perennials are usually grown in a greenhouse or conservatory. They require protection during the greater part of the year.

For starting plants indoors a greenhouse or hotbed is best, but they may be started very satisfactorily in shallow boxes or earthenware seed pans in a window in a reasonably warm room in the house.

In the bottom of the box, or flat, which should be only two or three inches deep, should be placed an inch of broken pots or other coarse material to insure perfect drainage. The box should then be filled to within about a half inch of the top with finely sifted soil consisting preferably of equal parts of sand, leaf mold and light garden loam. Fertilizer should not be used until the plants are transplanted.

The soil should be pressed down firmly and evenly and watered thoroughly the day before the seed is to be sown. Sow the seed thinly on the surface, and cover with finely sifted soil pressed down firmly. Very small seeds should be barely covered; larger seeds may be covered to a depth of about one-eighth of an inch. Many failures are on account of covering the seeds too deeply.

Cover with a pane of glass or sheet of paper, to prevent too rapid evaporation of moisture, and keep in a temperature of as nearly sixty to seventy degrees as possible.

Watering is of the utmost importance. The soil must not become dry, and it is fully as important that it should not be too wet. It is best done with a fine spray.

Remove the covering after the seeds have germinated. When the plants are large enough to handle they should be transplanted into similarly prepared boxes, an inch or more apart each way, or into small pots, to be kept until time to plant outdoors. The soil should be rich, and may be fertilized with well-rotted manure or commercial fertilizer.

The plants should have an abundance of air, and should be gradually hardened off before they are set outdoors.

When setting the plants outdoors they should be allowed plenty of room, and the soil and location should be suitable for that particular species. To get pleasing and artistic results they should be placed with regard to height, color and time of blooming to harmonize with other plants, shrubs and surroundings. There is unlimited opportunity for display of taste, and in this lies one of the greatest pleasures of gardening.

AGERATUM (Floss Flower)

The best hardy annual for blue effects in the garden; generally used in bedding and borders in contrast with such plants as geraniums, amaranthus, etc.; also exceedingly attractive when mingled with alyssum, candytuft, and similar plants. They succeed in almost any soil and climate. The plants are neat, bushy and erect, with a continual profuse clustering of pretty brush-like flowers throughout the season. Grows six to eight inches tall, and should be planted eight to twelve inches apart. For early bloom the seed should be sown in cold frame or in boxes in the house in March and transplanted in May, but for summer and fall bloom the seed may be sown in well prepared beds in early spring. Seed sown in August will produce plants for winter flowering.

ALYSSUM (Sweet Alyssum)

There are both annual and perennial varieties of this pretty little plant. They are both hardy, and are excellent for borders, beds, baskets, pots, rockeries, and for cutting. They grow about nine inches high and are covered with a profusion of small white flowers during the summer and fall.

The seed of either variety may be sown in fall and the plants wintered over in a cold frame, may be started indoors early in spring, or may be sown when the ground is in good condition to work in spring in the position in which the plants are to remain, and the plants thinned to about four inches apart.

ANTIRRHINUM (Snapdragon)

This is a valuable border plant, and although it is a perennial, it may be treated as an annual, blooming the first season from seed. The bright colors and peculiar form of the flowers are attractive, and the spikes are useful for cutting, as they keep fresh a long time. Seed may be sown in the open ground in May, and the plants will bloom in August, but for early bloom, the seed should be sown in the hot-bed in February or March, and the plants transplanted into beds of warm, dry, rich soil early in May. They grow about eighteen inches tall, and should be planted six inches apart. During the winter they should

be protected with a light mulch, and will bloom early the next spring. one foot apart; or the seed may be sown in the fall and the plants will bloom the following season. They will thrive with ordinary garden soil and culture, but do best in a partially shaded, well-drained location. Few hardy perennials are so easily grown from seed.

ARABIS (Rock Cress)

A hardy perennial and one of the earliest and prettiest spring flowers. The spreading tufts are covered with a sheet of pure white flowers very early in spring. It withstands drought, and is unequalled for rockeries and edging. Grows six inches high and a foot or more in diameter. Sow the seed in fall or spring, preferably in seed bed, to be transplanted when wanted. May be propagated by division of plants or by cuttings.

ASTER

The aster is certainly one of the most satisfactory annual flowering plants. The great variety in its size, color, form and season of blooming makes it a most satisfactory plant for supplying cut flowers. In fact, many of the improved sorts produce flowers equal in form and size to some of the better sorts of chrysanthemums. The habit of growth adapts the aster not only to close planting for cut bloom, but some forms are robust, tall-growing plants, well adapted for use in an herbaceous border where late bloom and careless effects are desired. The more compact-growing, large-flowered forms are most desirable for cut blooms, while the tall-growing, open types are most useful in wild gardens or for screens. The vigor and ease of culture of the aster are factors which contribute to its popularity. Plants from seed sown in the open ground in the May bloom in September and October, when the flowers are seen at their best. For July and August bloom, the seed should be sown in March in cold frame or in pots or boxes in the house. Cover the seeds one-half inch deep in rich, light soil and when the plants have three or four leaves transplant to other boxes or pots, setting the plants about two inches apart. After all danger of frost is past transplant to the permanent bed, setting them twelve to eighteen inches apart, according to variety. If manure is used it should be thoroughly rotted. Commercial fertilizers are best. Fresh manure, or even well-rotted manure in too large quantities, is often injurious to asters. They require rich, well prepared soil and plenty of water.

BALSAM (Lady Slipper)

A native of India, the garden balsam loves a hot sun, rich soil and plenty of water. The young plants are quick, sure growers and from seed sown in the open ground in May soon form handsome bushes thickly massed with large, rose-like flowers. Transplanting two or three times has a tendency to dwarf the plants into better shape and make the flowers more double. They should be given plenty of space to develop, and should not be planted closer than twelve to eighteen inches each way. The flowers are produced on the under side of the leaves or inside the plants and show to the best advantage when planted in the margin of groups or to crown a terrace. For early bloom the seed should be sown in March in a gentle hot-bed or in the house, and when large enough transplanted to other boxes or pots, and to the permanent bed when danger of frost is past. An abundance of light and water is required.

BELLIS (English Daisy)

A favorite half-hardy perennial border plant which will live outdoors over winter if protected with a light mulch. Pretty double flow-

ers in white pink and red are produced lavishly from early spring until well into the summer. They bloom the first year from seed, and best results are obtained by growing new plants each year. Plants may be started indoors in February or March, or the seed may be sown in seed bed or permanent bed early in spring, but it is best to sow the seed in September and winter the plants over in a cold frame. They thrive best in a moist soil and cool atmosphere. The plants should be set about six inches apart.

CALENDULA (Pot Marigold)

A hardy annual, about a foot high, blooming freely and earlier than the marigold. The coloring of the large, shown flowers ranges through all the shades of yellow from ivory to deep orange. Should be planted eight to ten inches apart in masses or borders. A moderately rich, light soil is most congenial to these plants, but they will thrive in poorer soil than almost any other plant. The seed may be sown in the open ground early in spring and will bloom continuously from early summer to late in the fall.

CALLIOPSIS (Coreopsis)

One of the showiest and most easily grown of garden annuals, with graceful long stemmed flowers well suited for bouquets. The plants form perfect little bushes about two feet high and are a perfect mass of yellow, maroon and brown flowers from early summer until killed by frost. For early blooms the seed should be sown in cold-frame or in boxes in the house in March and transplanted to the bed in May, or it may be sown in the open ground in May and thinned to ten or twelve inches apart.

CANARY-BIRD VINE

A beautiful half-hardy annual climber growing ten to fifteen feet high and bearing charming little canary-colored blossoms. The plants may be started in boxes or pots, or in a hot-bed early in spring; or the seed may be sown outdoors after danger of frost is past.

CANDYTUFT

The candytufts are among the best white flowers for edging beds, for planting in belts, beds, or massing, for rockeries, and for cutting. Several of the varieties are fragrant, and all are profuse bloomers. The seed should be sown outdoors in April where the plants are to bloom, and well thinned when they have grown about an inch high. Make a second planting a month later, and a third late in July for fall flowers. September sowings will give winter-blooming plants. The soil for best results should be rich, and the plants given an abundance of water. They branch freely, and if some are removed the flowers will be larger.

CANTERBURY BELLS (Campanula)

These fine old plants are rich in color, profuse in bloom, and of easy culture. For outdoor effects, when planted in quantity, they are glorious, and the finest full-blown specimens can be transplanted to pots for house decoration by soaking the soil about them with water and lifting them with a ball of earth. They are biennials, and bloom the second year from seed, growing about three feet high and bearing a profusion of double and single varieties of bell-shape blue, white, purple and red flowers. The seed should be sown outdoors early in July, and the plants transplanted to cold-frame in October setting them six inches apart. In May they should be transplanted to the permanent bed eighteen inches apart.

CARNATION (Dianthus)

These splendid half-hardy perennials reach their highest state of perfection when grown

in greenhouses for winter cut flowers, but may be grown very satisfactory outdoors in summer. For greenhouse culture the plants are generally grown from cuttings, for those grown from seed are more variable.

The seed may be sown in hotbed or in boxes in the house early in spring. The plants should be transplanted in small pots when they are large enough to handle, and shifted to larger pots as they grow. They should not be set outdoors until all danger of frost is past. If left outdoors during the winter they must be well protected. The Marguerite Carnations are probably the most satisfactory for outdoor culture, and may be treated as annuals. They require a rich soil and plenty of moisture.

CELOSIA (Cockscomb)

An odd and picturesque decorative feature of the garden. The dwarf varieties make novel and attractive borders; the tall ones form striking groups. For winter bouquets they are cut before fully ripe, and dried in the house. They are hardy annuals. The seed may be planted in hot-bed or in boxes or pots in the house in March or April, and the young plants transplanted to the garden in May, or the seed may be planted in the open ground in May. Transplanting into rich soil about the time the combs begin to form will make the flowers heads much larger. The dwarf varieties grow about six inches high, the tall varieties one foot. They are bright from mid-summer until frost.

CENTAUREA

(Cornflower, Bachelor Button, Sweet Sultan)

In this are embraced several quite distinct hardy annuals. They are of the easiest culture, grow about eighteen inches high, and are excellent for beds, borders and cut flowers. The seed may be sown in seed bed or permanent bed either in fall or early spring. The plants should be set about four inches apart.

CHRYSANTHEMUM

The large-flowered types of chrysanthemums, which produce such gorgeous shows in the florists' stores, are not hardy, and must be grown in the greenhouse. The annual chrysanthemums bloom most satisfactorily if the seeds are sown early in a hot-bed or cold-frame and the young plants transferred to the open as soon as the soil has become sufficiently warm to keep them growing without check. They should be set ten inches apart in their permanent location. Somewhat less satisfactory results can be secured by sowing the seed in the permanent bed early in May, and thinning the young plants to eight inches apart. If the same care in regard to disbudding and pinching back is taken with the annuals as with the large-flowered perennials the work will be rewarded by the greatly increased size of the flowers.

CINERARIA

Tender perennial greenhouse and pot plants bearing profusely daisy-like flowers in white, blue, violet and crimson shades. The seed should be sown in flats in a greenhouse in January, merely pressing the seed into the soil and covering very lightly with finely sifted soil. Water with a fine spray. Transplant to small pots when large enough to handle, and shift to larger pots as the plants grow. They may be set outdoors in a shaded position when the weather is thoroughly warm.

COBAEA SCANDENS (Cups and Saucers Vine)

This is a rapid-growing, annual, climbing vine, easily grown from seed, and sometimes attains a height of forty-feet in a season. The dark color and refined character of its foliage, together with its bell-shaped flowers, render it

a very satisfactory vine for covering broad areas. The flowers are not conspicuous, because of their modest colors and because they are hidden by the foliage, their form, however, is pleasing, and they, unlike the moonflower, are open during the day. Seed should be planted in hot-bed, and when the plants have developed their first true leaves should be transferred to three-inch pots and kept growing slowly until danger of frost is past, when they should be planted in their permanent position. The soil should be very rich, and they should have plenty of water. Poultry netting makes the best trellis, as they fasten themselves by their tendrils rather than by twining.

COSMOS

A favorite, late-flowering annual, especially adapted to the Pacific Coast, growing three to four feet high and bearing bright, bold flowers four inches in diameter. Most effective when planted in masses or background borders. Seed may be started in the house in March, or may be sown in the open ground in May, and the plants thinned to eighteen inches apart. Will thrive in ordinary garden soil.

DAHLIA

Dahlias are generally grown from bulbs, but may be grown from seed and will bloom the first summer and fall. For early blooms the seed should be sown in boxes or pots in greenhouse, hotbed, or in the house. Transplant one inch apart when the plants have developed three leaves, and set outdoors when danger of frost is past. In mild climates the bulbs may be left in the ground during the winter if protected with a mulch. In colder climates the bulbs should be taken up in the fall and stored in sand in a dry place. Plants grown from seed produce blooms in a great variety of shapes and colors, some of which are beautiful and others unwise.

DAISY (Shasta Daisy)

This splendid hardy perennial grows two to two and one-half feet high and produces an abundance of showy flowers four inches in diameter with pure white petals and yellow centers. Sow the seed in seed bed or cold-frame in fall or early spring. Transplant to permanent bed about six inches apart. The seed should be soaked in warm water before sowing.

DIGITALIS (Foxglove)

The tall flower-stems of the foxgloves are particularly attractive when seen growing among shrubbery or in bold masses along walks or drives. They are perennials, blooming the second year from seed, growing three to five feet tall and producing long spikes of large flowers in various colors. Seed may be sown in the open ground in May and the plants transplanted to the permanent bed when large enough, or the next spring, setting them about two feet apart. When the center spike begins to fade it should be cut out, and the side shoots will then grow more vigorously.

ECHINOCYSTIS (Wild Cucumber)

A quick-growing hardy annual vine with dense bright green foliage and white flowers. Splendid for a quick temporary covering for trellises, fences, stumps, etc. Sow the seed in fall or early spring where the plants are to grow. The plants may be started in boxes or pots if desired.

ESCHSCHOLTZIA (California Poppy)

The eschscholtzia is the state flower of California, and an annual of striking character, both as regards the form and color of its flowers, which are bright and rich in their tints of yellow and orange. The plants aver-

age about a foot in height, have attractive, silvery foliage, and produce their large poppy-like flowers quite lavishly from early spring until frost. They are most effective when grown in beds of considerable size, over which the seed may be thinly sown broadcast and lightly raked in. These sowings may be made early in spring, or late in autumn for earlier germination and bloom the next spring. The *eschscholtzia* is also very useful as a pot plant and for cut flowers.

GAILLARDIA

The annual *gaillardias* are easily grown from seed sown in the open ground in May, plants in a hotbed or in the house in March, but earlier flowers may be had by starting the and transplanting outdoors early in May. They grow in a compact bushy form, about one foot high, and should not stand closer than one foot apart. They do best in light, well-drained, fertile soil, fully exposed to sun and air. There are also perennial varieties.

GYPSOPHILA (Baby's Breath)

Hardy annuals and perennials growing one to two feet high and producing a profusion of small star-shaped flowers, mostly white; useful for hanging baskets and for mixing with bouquets. Sow seed of the annual varieties early in spring, and at intervals for succession, either in beds, seed beds, boxes, or pots, and thinned or transplanted about one foot apart. Seed of the perennial varieties may be sown in spring but it is better to sow in September and winter over in a cold frame.

HOLLYHOCK

These too frequently neglected old-fashioned perennials are most pleasing and attractive when seen in groups or long rows against hedges or shrubbery as a background, and, in turn, form a very satisfactory background for plants of lower growth. They are easily grown from seed, which should be sown in the open ground in May, and the young plants transplanted to the permanent position not closer than two feet apart. The plant is amenable to training, and if the tip of the main stalk is pinched off it may be kept at any desired height, and the side branches will then develop and form a bush.

IPOMOEA

(Moonflower Vine. Evening Glory)

Rapid-growing half-hardy annuals quickly attaining a height of ten to fifteen feet, producing a dense mass of heart-shaped leaves and a profusion of beautiful large flowers which open at sunset and close in the morning. The plants may be started indoors early in spring, or the seed may be sown outdoors when danger of frost is past.

LARKSPUR (Delphinium)

The annual varieties are quite hardy, and the seed may be sown in the open ground in the fall, and will germinate very early in spring, or it may be sown early in spring. The tall varieties are suitable for shrubberies and borders, and the dwarf varieties for beds. Either are splendid for cutting. They bloom best in rather cool, moist soil. They should be thinned to stand six to eighteen inches apart, according to variety. There are also perennial varieties.

LOBELIA

These charming little half-hardy annuals grow four to six inches high, forming compact little bushes literally covered with small bright flowers. For beds, edgings, baskets and pots there is nothing prettier. The seeds may be sown outdoors in early spring, thinning or transplanting the young plants four or five inches apart. There are also tall, perennial varieties.

LUPINS

Free-flowering easily grown annuals, about two feet high, with long graceful spikes of rich and various colored pea-shaped flowers. Valuable for mixed borders, beds and for cutting. Does best in partial shade. Sow the seed in fall or spring in permanent bed.

MARIGOLD

There are two distinct types of these garden annuals. The French marigolds are the most compact and regular in growth, and are useful for bedding. The African marigolds grow two feet or more in height, and are better suited for planting in mixed borders or among trees and shrubs. The seeds of either type may be planted in the open ground in April, but earlier bloom may be had by starting the plants in the house.

MIGNONETTE

No garden is complete without a plentiful supply of this hardy annual. The seed can be sown outdoors at any time after the middle of April, and if planted at intervals of three weeks until August, its fragrant, modest colored flowers may be gathered until November. It grows about one foot high, and should be thinned to eight to twelve inches apart.

MIRABILIS

(Marvel of Peru. Four O'Clock)

A perennial in warmer climates, but here it is treated as a hardy annual. It is a quick-growing, erect, bushy herb, attaining to a height of two to three feet, and blooming during the late summer and autumn. The flowers open only late in the afternoon and on cloudy days. The seed should be planted in the hot-bed or in the house in March and transplanted to the open ground in May, setting the plants about one foot apart. They sometimes manifest their perennial habit of developing tuberous roots sufficiently large to be lifted and stored like those of the canna.

MORNING GLORY

These well known hardy climbing annuals are rapid growers and are well covered with foliage and pretty flowers, making them useful for covering summer-houses, verandas or other structures where quick effects are desired. The seed should be sown in May, in any good garden soil, in the location in which they are to remain, and thin the plants to one foot apart. There are also dwarf varieties, growing about one foot high, which are useful for bedding or borders.

MYOSOTIS (Forget-Me-Not)

These dainty little flowers are hardy perennials, love cool, moist soils, and, like pansies, bloom most freely in fall and early spring. They are good in borders, also satisfactory as winter-blooming plants in a cool room or cold-frame. Sow the seed in early spring in a warm, sunny border. They bloom freely in the first season, and profusely the second year. They grow about six inches high, and the plants should stand six inches apart.

NASTURTIUM

No other annual will produce such a profusion of flowers for so long a time with the same outlay of time and labor. They bloom profusely during the entire season from early summer until killed by frost, and will thrive almost anywhere, and under almost any conditions. They produce the best blooms if the soil is not too rich, and require very little moisture. Rich soil and too much water will produce luxuriant foliage at the expense of flowers.

The tall varieties grow about five feet high, and are splendid for covering fences, walls, steep banks, or other unsightly places. The

flowers are a little larger than those of the dwarf varieties. They should be planted in spring, after all danger of frost is past, in the position in which they are to remain, planting the seed about one inch deep, and the plants thinned to six inches apart. They can also be grown as pot plants for winter flowering for screens, or as trailers for hanging baskets.

The dwarf varieties have a neat, compact, habit of growth, forming a small, round bush about a foot high, with attractive foliage, and a profusion of large yellow and brown flowers nestled in among the green leaves. The seed should be planted about one inch deep, after the weather is thoroughly settled in spring, in the position in which they are to remain. If the seed is planted thinly it will not be necessary to thin the plants, as they will stand considerable crowding. A few plants may be started in pots in the house in early spring and transferred to the open ground when warm weather has come to stay, if early blooms are desired.

Nasturtiums are not troubled with any disease or insect pests. The seeds and pods may be pickled, and the leaves are used like cress, in salads.

NIGELLA

(Love-in-a-Mist. Devil-in-a-Bush)

Compact, free-flowering hardy annuals growing in bush form about one foot high. The foliage is finely cut, and the flowers and seed pods are unique. Sow the seed outdoors after danger of frost is past, and at intervals during the summer for succession. For early blooms the plants may be started indoors early in spring, or the seed may be sown in fall and the plants wintered over in a cold frame.

PANSY

The pansy is a hardy perennial, requiring a cool, moist climate, and for that reason attaining the highest state of perfection west of the Cascades, where the largest and brightest blooms are produced in the greatest profusion and continuously from early spring until late in the fall. It is a favorite with everyone, and gives satisfactory results with a moderate amount of care. For early outdoor bedding, the seed is sown late in August or early in September in rich garden soil, in a cool location, and as soon as the plants are large enough to handle they are transplanted four inches apart in cold-frames. On the Pacific Coast, during our ordinary mild winter weather, the cold-frames need not be covered, the sides affording sufficient protection, but in case of very cold weather they should be covered with canvas or burlap. Early in spring, they should be transplanted, not less than one foot apart, in permanent beds. After this the only winter protection they will need is a light mulch of manure. East of the Cascades, or in other warm, dry climates, they should be planted on the north side of the house, or other shaded location; in fact, even on the Coast, they do best in a partially shaded position. Satisfactory results for the home garden, although not as early blooms, may be had by sowing the seed in cold-frame in early spring, so that they will have a good root system before hot weather.

There are four essentials for best results. First, good rich, loamy soil that will hold moisture well. Second, frequent cultivation, to keep a dust mulch on the surface and to allow circulation of air in the soil. Third, to pick all blossoms as soon as they are past their prime, as they will be larger and more perfect as the season advances if seed-pods are not allowed to form. Fourth, plant in a cool position. Frequent applications of bone meal, cultivated into the soil, will be very beneficial.

PETUNIA

A tender perennial, of several distinct types variously adapted for greenhouse and pot culture and for open air. The seed should be sown in March, in a gentle hotbed, cold-frame, or in a box in the house, and the seedlings transplanted about a foot apart, in rich garden loam, after all danger of frost is past, and the ground has become thoroughly warmed. The seed should not be covered, as most other seeds, but should be merely sown on the surface, and pressed slightly into the soil. The double varieties are more difficult to grow than the single varieties.

PHLOX

The annual phlox, sometimes called flame flower, is particularly useful and attractive when grown in masses or ribbon beds of contrasting colors. Fed annual plants are more easily grown from seed, give a quicker return of bloom, or offer such a variety to choose from as do the phloxes. There are few desirable colors beyond their range, and if given good soil and plenty of water they furnish a supply of delicate flowers for cutting throughout the season. They are also useful in the window garden, and as undergrowth for tall, bare-stemmed plants. The first sowing of seed should be made very early in spring, and later ones in May, either where the plants are to bloom or in a seed bed, as the phlox transplants readily. In transplanting, set the taller kinds about a foot apart; if planted too thickly they suffer from mildew. The removal of flowers and seed-pods makes the plants more bushy and compact, and lengthens their blooming period. The tall varieties grow about twelve inches high; the dwarf varieties about six inches.

PINKS (Dianthus)

The large and varied genus of *Dianthus* contains some of our most beautiful flowers. The most of them are hardy perennials that bloom freely the first season, the plants remaining green all winter and blooming the next year if protected by a mulch. Old plants flower the earliest, but as young ones give the best flowers, new plants are usually grown each year. Seed is sown in the hotbed or in the house in March, and the young plants transplanted out of doors, six to ten inches apart, in May. They do best in a well-drained bed made up of turfy loam, leaf mold, and well-rotted manure, thoroughly mixed. They will not stand too much moisture, and are more liable to winter-kill from being planted in a wet place than from cold.

The Carnation Pink is the carnation of our florists, and although usually grown in the greenhouse, and propagated from cuttings, it may be grown from seed sown in the hotbed in March, and the plants frequently transferred to pots of increased size as they grow larger, until the weather is thoroughly settled, when they may be transplanted in the border where they are to bloom.

The Sweet William is one of the most satisfactory of this group for annual planting. The seed may be sown in the open ground in May, and the plants thinned to eight to ten inches apart, but for early bloom the plants should be started in the hotbed.

The Scotch Pink, or Grass Pink, is a hardy perennial, but is very satisfactory when treated as an annual, in the same manner as the Sweet William.

The flowers of all the plants of this group are most satisfactory for bouquets and table decoration because of the length of time they will keep in a fresh and attractive condition after being cut and placed in water.

POPPY

No other plants possess so bold and brilliant a flower, coupled with the same grace of stem, airiness of poise, delicacy of tissue, and earliness and continuity of bloom as the poppy. For beds and borders, with a background of green, there is nothing which will produce a more striking contrast. A sandy loam suits them best, and as their strong tap-roots are difficult to transplant, it is well to sow the seed where the plants are to bloom. The seeds should be sown thinly, covered very lightly, and the young plants thinned to one foot apart. A long succession of flowers may be had by planting the seed in the fall and at intervals during the spring.

PORTULACA (Sun Plant)

This bright-flowered, thick leaved annual is unrivaled for brilliancy among plants of low growth. It flourishes under extremely adverse conditions, even in hot sun and light soil and with sparse water supply. It is satisfactory for beds, edgings and rockwork, and for filling up spaces in flower beds, also as an undergrowth for taller plants. It is particularly useful in the Northwest. The seed does not germinate until hot weather, and should be sown late. Beyond sowing the seed, no care or attention is required.

PRIMROSE

These half-hardy and hardy perennials are splendid for winter and spring decoration in the home or conservatory. The hardy varieties are used for beds and borders, and may be handled in the same manner as pansies. For winter flowering sow seed of the Chinese or *Obconica* varieties in boxes, indoors, from April to July, to insure blooming the next winter. The seed should be merely pressed into the soil and covered very lightly with finely sifted soil. Transplant to small pots when large enough, and shift to larger pots as the plants grow. Keep in a cool place so that the plants will grow slowly until ready for them to bloom.

PYRETHRUM

Very ornamental hardy perennial bedding and border plants growing one to two feet high. The seed may be sown outdoors as soon as the ground is in good condition to work in spring; or may be sown in fall, the plants wintered over in a cold frame, and transplanted to the permanent bed when danger of frost is past in spring.

RICINUS (Castor Bean)

The castor-oil plant, commonly spoken of as the castor bean, is especially valuable because it is one of the few annuals which can be used to produce a semi-tropical effect. Its rapid growth and large size makes it valuable as the central object in groups where rich, luxuriant growth is required. When used in combination with cannas, caladiums, coleus, or scarlet sage most striking effects of contrast can be produced. As a background for lower-growing plants the castor bean has no equal among garden annuals. They may be started in the hotbed or in boxes in the house in March, transferred to other boxes or pots as soon as the first true leaves have appeared, and transplanted out of doors late in May after all danger of frost is past. They should be planted two to three feet apart; if planted closer they will grow tall and spindling, and lose their lower leaves. They may be planted in the open ground at the time garden beans are planted and by the middle of August will make a growth of four to six feet. It requires rich, warm soil, plenty of moisture and full exposure to the sun.

SALPIGLOSSIS (Painted Tongue)

Very showy half-hardy annual bedding or border plants growing two to three feet high and bearing richly colored funnel-shaped flowers. For early bloom, plants should be started indoors in March, and transplanted to the bed, one foot apart, when the weather is warm and settled. Seed may be sown outdoors when danger of frost is past.

SALVIA (Flowering Sage)

Scarlet Sage, *Salvia splendens*, bears spikes of flowers of the most intense scarlet, and the flowers of Blue Sage are the deepest blue. They are standard bedding plants where brightness of color is desired. They are also useful as pot plants, for window boxes, and for cutting. The seed should be sown in the hot-bed or in the house in March, and the seedlings transplanted outdoors late in May. They grow about two feet high, and should be set two feet apart. They are perennials, but will bloom the first season if started in the hot-bed. The seed may be sown outdoors after the first of June, but the beds must be protected from the hot sun, rain and wind.

STOCKS

The plants are vigorous, have a good habit of growth, fragrant flowers in various colors, are adapted to bedding, edgings, pot culture, house or conservatory use, and are splendid for cutting. They are hardy annuals, grow about two feet high, and should be planted about one foot apart. For early blooms, the seed should be sown in the hot-bed, or in the house, in March, and when the plants are one inch high they should be transplanted to another part of the hot-bed. Frequent transplanting during their early growth will give them a more dwarf and compact habit. They may be planted in the open ground early in May. Seed may be sown outdoors in May, and will produce blooms in July or August. If plants that began to bloom late are carefully lifted and potted in the fall, they will flower freely in a house or room that is rather cool and moist.

SUNFLOWER (Helianthus)

These tall-growing, bright flowered annuals have suffered the misfortune of having been cheapened by use as a burlesque. They are in reality very useful for backgrounds, or even for bedding. The tall, single variety, with but one immense flower on a plant, with which we generally associate the name, is only one of the many varieties. The dwarf, double, many-flowered varieties are really useful and artistic when skillfully employed. The seed should be planted in the open ground about the middle of May, and the plants thinned to stand two to four feet apart, according to whether dwarf or tall.

SWEET PEAS

These, most beautiful of the hardy climbing annuals, are very easy to grow, and thrive under ordinary garden conditions with very little care, but a little extra care will be amply repaid in larger and earlier blooms and brighter colors. The climate of the Pacific Coast is ideal for their best development, and in no other locality will they produce blooms in such wonderful profusion and perfection.

On the Pacific Coast, where the ground does not freeze to any depth, the best time to plant is in November. They will apparently make very little growth during the winter, and it is better if the tops do not show about the ground until spring, but they will make a remarkable amount of root growth which will induce a strong growth of vines early in spring, producing better blooms and much earlier than if planted in spring. They may,

however, be planted in February, March or April, and will do very well.

The location should be open, away from trees and shrubbery, where they will get plenty of sunlight and air. They will thrive on any good garden soil, but a rich clay loam will produce the brightest colors. The ground should be well drained, especially if planted in the fall. A heavy application of well rotted manure should be spaded under and thoroughly mixed with the soil, more to improve the mechanical condition and make it warm and porous than as a fertilizer, and after the seed is planted the ground should have a liberal top dressing of manure to protect it from the cold, keep it from packing, and to induce early growth in the spring. The seed should be planted about two inches apart in furrows; if planted in the fall the furrows should be six inches deep; if planted in the spring they should be from two to four inches deep; early plantings should be deeper than late plantings. Early in spring, if there is a hard crust on the ground, break it by raking over the rows. As soon as the plants are up cultivate frequently and thoroughly. An occasional top-dressing of well rotted manure, bone meal or commercial fertilizer, will be beneficial.

East of the Cascades it is probably best to plant in the spring, as early as the ground can be worked properly, but in the eastern states fall planting is now practiced to some extent, and in some cases, at least, is successful. It is worth trying.

If this seems to be too much trouble, and you are not particular to have the largest, brightest and earliest blooms, they may be planted the same as garden peas, and given the same attention and cultivation, and will furnish a profusion of very satisfactory blooms during the greater part of the season.

As they grow about six feet high, they require a trellis of some sort, and six foot poultry netting makes the best support, and the easiest to construct. They require considerable water, and it should be applied to the roots only; do not sprinkle the foliage. All of the blossoms should be picked each day; otherwise they will go to seed, and stop blooming. The more flowers you pick the more you will have.

FLOWERING PLANTS GROWN FROM BULBS OR ROOTS

HYACINTH

Hyacinths are easy to grow, and there are few things that will give more pleasure than a bed of perfect blooms in the garden early in spring, or a few choice specimens in the house during the winter.

For outdoor culture the bulbs are best planted in October or November, but are sometimes planted later, or very early in spring. Any rich garden soil is suitable, but it must be well drained or the bulbs are liable to rot during the winter. Bone meal is the best fertilizer for bulbs, and large quantities thoroughly mixed with the soil will produce larger and more perfect blooms. The bulbs should be set six to eight inches apart, with the top of the bulb four inches below the surface.

If it is desired to remove the bulbs from the bed during the summer, they should be taken up after they are done blooming, without removing the tops, and replanted or healed in an out-of-the-way corner of the garden to mature; after which they should be spread out in a cool, dark, dry, airy place until time to plant the next fall.

For indoor culture, in pots, for winter blooming, plant one bulb in a four-inch pot, as early as possible, from September to December. The bulb should be set so that the top will show above the surface of the soil. Water thoroughly and set the pots in a cool, dark place

SWEET WILLIAM (*Dianthus Barbatus*)

Well-known, attractive, free-flowering, hardy perennials, producing splendid effects in beds and borders. Sow the seed outdoors early in spring in seed bed or permanent bed, and transplant or thin the plants to about six inches apart; or the seed may be sown in fall, and the plants wintered over in a cold frame. Although they are perennials, flowers will be produced the first summer, and best results will be had by growing new plants each year.

VIOLET

These little hardy perennials are unexcelled for borders and for cutting. The plants are hardy, requiring the same care as pansies, but they are rather difficult to grow from seed. It is best to sow the seed early in fall, wintering the plants over in a cold frame.

VERBENA

The Verbena is a low-growing, creeping annual, and is useful in beds, borders, mounds, window boxes, and for bouquets and table decoration. The seed should be sown in March, in the hot-bed or in the house, and the plants transplanted outdoors after all danger of frost is past, setting them ten to fifteen inches apart in well-drained garden soil and a sunny position.

WALLFLOWER

Well-known, deliciously fragrant, half-hardy perennials, producing spikes of beautiful flowers early in spring. The seed should be sown early in the fall, the plants wintered over in a cold frame and set out when danger of hard frost is past in spring.

ZINNIA

A half-hardy annual, growing about eighteen inches high, and producing a multitude of large double flowers of a great variety of colors and shades, valuable for groups, beds, borders, or hedges, and for bouquets. The seed may be sown in the open ground in early spring, and the plants thinned to two feet apart. They will be at their best in August, and will continue to bloom until late in the fall.

in the cellar, covering the pot with sand or ashes, until well rooted. This will require about six weeks. They will bloom soon after being placed in a light, warm place. Time of blooming can be regulated by placing them in the light at the proper time.

For glass culture, fill the glass so that the bottom of the bulb will just touch the water, and set away in a cool, dark place until well rooted. Change the water frequently.

The secret of successful indoor culture is keeping the bulbs in a dark, cool place, and not placing them in the light until they are thoroughly rooted.

TULIP

The culture of tulips is practically the same as for hyacinths, except that they may be set a little closer together and need not be covered quite so deep. Pot culture is the same as for hyacinths except that three or four bulbs may be set in each pot.

MARCISSUS, DAFFODIL, JONQUIL

The various forms of narcissi are among the most beautiful and satisfactory flowers, and after being planted require little or no care for years. Ordinary garden soil is suitable. If stable manure is used for fertilizer, it should be well-rotted and applied as long as possible before the bulbs are planted. Bone meal is the best fertilizer for this purpose.

The bulbs should be planted as early in the fall as possible, but may be planted as late as December. They may be set six to twelve inches apart, and covered about three inches deep. The bulbs will multiply rapidly.

Indoor culture is the same as for tulips.

CROCUS

The crocus is the first flower to bloom in spring, and is especially pleasing and effective when planted in clusters in the lawn. They will be done blooming before it is necessary to mow the lawn, and after that will not be seen again until the next spring. They should be planted in October, November or December. All that is necessary is to make a small hole in the sod and insert the bulb.

PEONY

While the peony will exist in almost any soil, it will produce only inferior flowers in a shallow, sandy or gravelly soil, and in such soils the surface of the bed should be dug out to a depth of twelve or fifteen inches, and filled in with six inches of well-rotted cow or horse manure, which should be thoroughly spaded into the sub-soil. The balance of the excavation should be filled with rich loam to which should be added a liberal quantity of coarse bone meal. If the soil is very heavy, a large quantity of well-rotted manure should be spaded in and thoroughly mixed with it, to lighten and enrich it, as the peony is a gross feeder, likes a rich loam, and will not thrive in a poorly drained, sticky soil. The plants should be set at least four feet apart each way, as they require this amount of room for full development.

While peonies may be planted in late winter or early spring, the best time for planting is as early after the middle of August as the bulbs become ripened, not later than the first of October. When planted at this time they will mature a year earlier than if planted in the spring.

In setting the plants, the crowns should be three to four inches below the surface of the soil, and the soil should be pressed firmly around the roots. The center of the bed should be slightly crowning, so that water will not stand on it. After the bed is planted, it should be mulched with three or four inches of coarse, strawed manure. During the blooming period, if weather is dry and plants need water, supply it by irrigation; do not use a springler. Peonies prefer a sunny position, and are excellent for use by the side of walks, back of a border.

GLADIOLUS

The new large-flowered varieties have been so improved that they are very different from the old-fashioned gladiolus, and among the most popular and satisfactory of our garden flowers grown from bulbs. They thrive and bloom in ordinary garden soil, with little care and attention, and make a display which is unexcelled. The flower stalks are two to three feet long and are covered with flowers, three to four inches in diameter, the coloring of which is magnificent, and they will last a week or more after being cut. They bloom continuously from the last of July until killed by frost.

They will thrive in an ordinary rich soil, but a liberal application of bone meal will improve the quality of the bloom and the colors. The soil should be well drained. They should not be watered excessively. They make the best display in beds or in clusters among shrubs, roses or peonies, care, of course, being taken that the colors harmonize.

Large bulbs will produce flowers the first season. Plant at intervals from April to June, three inches deep and six inches apart. In the fall, before the ground freezes, dig up the bulbs, cut off the stalks and store in

a cool, dry place. The bulbs increase rapidly, so if you start with one bulb of each of the best varieties you will soon have an abundance.

DAHIA

Dahlias will thrive in any good garden soil, but do best in light, well-drained soil, with full exposure to the sun. They may be planted any time after the ground is in good condition to work until the latter part of June; early planting is preferable. Large quantities of stable manure and commercial fertilizers may be used advantageously.

In dividing the clumps of roots the crown or ostem must be split in such a manner that each tuber bears a short piece of stem on which there is at least one eye. The eyes, are not on the tubers, as is the case with potatoes, but are on the crown just above the tubers. Sometimes the eyes are difficult to distinguish, and it may be necessary to place the clumps of tubers in a warm, moist place for a short time to start the sprouts before dividing.

There are several ways of propagating dahlias, but the most satisfactory method, for amateurs at least, is to plant the large roots or tubers. The tuber should be planted on its side with the crown covered about six inches deep. They should be set two to four feet apart.

Ordinarily dahlias need not be watered, but if they show signs of requiring moisture, the ground should be thoroughly soaked to a depth of a foot or more, without watering the plants. When the ground has become dry enough to work it should be cultivated to prevent baking.

All but one or two of the best shoots should be removed, and each plant should be trained to a stake to support it. If the plant becomes too bushy, the surplus branches and foliage should be pruned off. The buds are usually formed in groups of three. The two outside buds should be pruned off, causing the remaining bud to make a much finer specimen.

When the foliage is destroyed by frost the stems should be cut off close to the ground and the roots dug. They should be exposed to the sun for a few hours to dry, and then stored in a dry cellar or other place where the temperature will remain at about fifty-five degrees. They should be watched during the winter and if they show signs of shriveling they should be covered with papers and the papers should be sprinkled slightly. Starting to sprout indicates that they are getting too much moisture.

ROSE

In no other place are roses grown in such perfection and so easily as on the Pacific Coast, and although they are produced in great profusion, if we fully appreciated our great advantage over our less fortunate neighbors, we could find many waste places in which to plant more.

In Western Washington or Western Oregon they may be planted either in the fall or early spring; east of the Cascades it is better to plant in early spring; and in California they should be planted in the fall.

Good roses may be grown in almost any soil and position, but the best quality is produced on a rich clay loam, in an open, sunny position, sheltered from cold winds, and clear of all roots of trees and shrubs. The ground must be well drained, either naturally or artificially, so that water will not stand within two feet of the surface at any time during the year. Roses require considerable moisture, but the roots must not be submerged in water.

It will be worth while to give considerable care to the preparation of the bed, for it will be occupied for many years, and during that time little can be done to improve it except top-dressing. The extra trouble will be amply

repaid in blooms which you may be proud of. An excavation should be made about two feet deep and filled in to a depth of one foot with bones broken in small pieces, charcoal and good soil; then fill balance of excavation with clay loam in which has been mixed a liberal quantity of bone meal, well rotted manure (cow manure preferred), slacked lime, and, if the soil is heavy, a little sand. Then soak the bed thoroughly with water, to settle it, and let it stand a few days until dry enough to work properly, when the surface should be thoroughly loosened and pulverized before planting.

Select strong, healthy plants with good roots. Get two-year-old plants if blooms are wanted the first season. One-year-old plants will be just as good eventually, but they should not be allowed to bloom until the second year. The tops are usually cut back sufficiently when received from the nursery. Remove any damaged roots, and cut ends of roots back a little. Plant about two feet apart, making holes large enough so that the roots may be spread out in their natural position, setting the plant a little deeper than it stood in the nursery row; fill in the earth, tramping it firmly around the roots as it is filled in, and leave a little loose soil on the surface. After planting is completed smooth the bed nicely with the rake and apply a top-dressing of well-rotted manure and bone meal; the manure to serve as a mulch and the bone meal as fertilizer. Bone meal is the best fertilizer for roses, containing a large amount of phosphoric acid in the best form and producing the most perfect flowers and delicate colors.

Unless a good mulch is maintained the bed should be cultivated once a week and after each rain. In any case it should be thoroughly cultivated as soon as the ground is in proper condition in the spring. If well mulched it will only be necessary to pull the weeds and cultivate in case the ground becomes hard, cultivating the mulch into the soil and applying a new mulch. Water when the soil two inches below the surface will not pack when pressed between the hands, giving it one good soaking rather than continual sprinkling.

If flowers are wanted for individual beauty and perfection remove all buds except the terminal bud on each shoot; if for bedding effects little or no thinning is necessary.

The strong-growing varieties should have all canes cut back to about three feet in the fall to prevent being whipped by winter winds

which, unless staked, would loosen and break the tender feeding roots. The principal pruning should be done in spring before growth starts. If quantity of bloom for garden effect is the object sought, four or five canes may be left three feet in length, and all old or weak growth cut away entirely. After the plants are through blooming in the spring the canes should be shortened back at least one-half to induce another season of bloom.

If quality of bloom is desired, all weak growth should be removed, and the remaining canes cut back in proportion to their development, the weaker ones to about four inches from the root, and the stronger ones eight to nine inches. Canes should be cut off about an eighth of an inch above an outside bud; this will cause the plant to grow in an open head, as the buds usually grow in the direction which they first take. Roses pruned in this way will need no staking up or summer pruning, the cutting of flowers with long stems being sufficient. The Tea and Hybrid Tea varieties should not be pruned until they show evidence of growth, indicated by the buds beginning to swell, when dead or unhealthy wood may be readily detected, making it easy to see what should be cut away and what should be retained. They do not need as severe pruning as that described above for Hybrid Perpetuals, and all wood that looks promising should be left on.

Climbing roses require no pruning in the spring beyond the cutting out of old or dead wood and the shortening of the laterals and long canes to make the growth conform to the space to be covered, but a severe pruning directly after they have finished flowering is beneficial. Cutting away at that time all old flowering wood will encourage a vigorous growth, which will give an abundance of flowers the following season.

Rose bushes have several enemies which must be watched closely. For Rose Beetles, hand picking seems to be the only remedy. For Slugs, which eat the leaves, spray with arsenate of lead. Green Aphis is the most common pest. To destroy the eggs, spray with lime and sulphur solution before the leaves open; later, as soon as aphids are discovered, dust with tobacco powder or spray with a tobacco solution. Mildew is the most difficult disease to contend with. It is the result of severe fluctuations in temperature or stagnant air or soil conditions. Some varieties are more susceptible to it than others. Dust the foliage in the evening with sulphur or spray with potassium sulphide, one ounce to two gallons of water, or with tree spray.

THE LAWN

(From Farmers' Bulletin 494)

The greensward is the canvas upon which all architectural and landscape effects are produced. A lawn may vary in extent from a few square feet at the side of the steps leading to the brownstone front of the city dwelling to the broad acres of extensive parks. It matters little whether the extent of a lawn be great or small, its inherent qualities are the same, and its intrinsic worth is determined by its character and the manner in which it is kept. Green grass is not only of great economic value, but it is also of great esthetic value. The herbage of the field is the primary dependence of all animal life, and it is the green color, the sweet fragrance, and the soothing effect of nature which comes from well kept greenswards that make them so congenial to man. Grass is nature's balm and healing for all erosive scars. Nature abhors rough edges and broken places, and im-

mediately proceeds to cover such ugly spots with green grass. Man likes to get his feet upon the soil, but, better still, upon the soft, yielding greensward. Rich rugs and carpets do not give the elastic spring that the well-made and well-kept greensward yields.

A lawn is the accompaniment of every effort on the part of man to beautify the surroundings of his abiding place. The great increase of interest in suburban and rural life has caused a corresponding increase of interest in matters pertaining to the making and maintenance of lawns. Suburban railways, the extension of electric lines into the country, and the return of man to natural ways of living are all factors contributing to the growing interest in matters pertaining to lawn making.

Western Washington should be noted for its splendid lawns, for our climate is ideal for

them, and with a minimum of labor and expense we can produce those fine, velvety, carpet-like lawns which are the envy of our friends in less favored sections.

A perfect lawn cannot be made or maintained in the careless, half-hearted manner that is too often employed, but if we are willing to bestow upon it a comparatively small proportion of the care necessary to obtain the same amount of satisfaction in almost any other line, we will be rewarded with a lawn to be proud of.

We will not attempt a treatise on the arrangement of the lawn, for this is the work of a landscape gardener. However, we will suggest that it should not be dotted with trees, shrubbery and flower beds, but that they should be massed in corners and around the sides; also that, especially if the lawn is a large one, natural contours are usually more beautiful than a formal, uniform grade; and that curved walks and roads are more effective than straight ones.

The best soil for a lawn is a deep, rich loam, containing considerable clay. This will retain moisture better than a light sandy or gravelly soil, and is less inclined to heave in winter. If the soil is not naturally of this nature, it should be made as nearly so as possible, and it should be the same in all parts, to avoid a spotted appearance. If it is not naturally well drained, it must be drained artificially, for not even a fair lawn can exist on wet, sour land. Do not attempt to make a lawn on the sub-soil which has been excavated from the basement when building the house.

Fertilizers should be used liberally. Large quantities of well-rotted stable manure should be turned under to a depth of at least eight inches. The idea is to have a thick layer of the manure to act as a sub-soil. If the lawn is being built up, the manure may be spread on the ground and eight inches or more of good soil placed on top of it. If the soil is inclined to be sour, about fifteen hundred pounds per acre of air-slaked lime or ground lime rock should be harrowed or raked into the top-soil. This will improve the texture, and will be beneficial whether the soil is sour or not. Bone meal should also be thoroughly mixed with the top-soil at the rate of about one thousand pounds per acre.

If possible, the soil should be prepared a considerable time before the seed is to be sown, the longer the time the better. The best lawn would be obtained by preparing the soil a year before sowing the seed, and working it frequently to destroy the weeds and make the seed-bed in perfect condition. Unless this is done you should bear in mind that though no seed of any kind is sown, a multitude of weeds and coarse grasses will spring up from the seeds which are in all soil. Sowing grass seed will not prevent these seeds from germinating, so if you have purchased high-grade seed, do not condemn your seedman if weeds appear in the lawn.

Just before sowing the seed, a commercial lawn fertilizer should be sown broadcast, and thoroughly raked in, at the rate of about five hundred pounds per acre.

If well-rotted stable manure cannot be procured, a crop of vetch or red clover may be grown on the ground and turned under when in blossom. In the case more of the commercial lawn fertilizer should be used.

The seed should not be sown until the soil is in perfect condition, not only perfectly smooth and finely pulverized on the surface, but in the same condition to a depth of eight inches or more. If the seed is to be sown during a dry season, the ground should first be thoroughly soaked with water, and then, when it is not sticky when pressed in the

hand, it should be carefully raked.

In the Puget Sound country the seed may be sown any time if plenty of water is available, but we prefer to sow late in spring. This will allow time for weeds and native grasses to make a start and be destroyed before the grass seed is sown. Of course this would not apply to hotter climates, or where water is not plenty. It should be sown when there is no wind blowing, and can be sown more evenly by sowing very lightly in one direction and then in other directions until the proper amount of seed is sown. Use plenty of seed, at least one pound of mixed lawn grass seed to each three hundred square feet of lawn, and it would be better to sow twice that amount. Do not economize on seed, either in quantity or quality; it is the least expensive part of the lawn. After the seed is sown, roll the ground with a light roller. If the seed is raked in at all, it must be raked very lightly.

Commence mowing as soon as the grass is two inches high, but never, at any time, cut it very short. Leave the clippings where they fall. Many lawns are ruined by removing the clippings. They make a splendid fertilizer, help to form a thick turf, and will not be unsightly if mowed frequently.

A good lawn cannot be maintained without the frequent use of a roller, especially in early spring. It compacts the soil after winter heaving, preventing loose soil about the roots for air to circulate in, discourages moles, makes a smooth surface for the mower, and induces a healthy and uniform growth of grass.

Never turn the lawn into a barnyard by covering it with stable manure. It is offensive to the eyes and nostrils, is tracked onto the walks and into the house, and it contains weed seeds. A commercial lawn fertilizer should be sown broadcast on the lawn at least once each year, at the rate of one hundred pounds to each twenty-five hundred square feet. It would be better to apply one-half or one-third of this amount two or three times each year, with one of the applications in August. It may be applied at any time, but if applied during warm, dry weather, the lawn should be sprinkled soon after. If the lawn turns yellow, or has an unhealthy appearance, an application of this fertilizer will rejuvenate it almost immediately. Commercial fertilizers do not contain any weed seeds. This is an important item, for it is difficult enough at the best to keep weeds out of the lawn.

There are weed killers on the market which are effective when properly applied. They are preparations containing sulphate of iron, and will kill all broad leaved weeds in a lawn without harming the fine-leaved grasses. They are liable to kill clover, but that is not a serious matter, as clover in a lawn is only valuable as a nurse crop and to make a showing while the grasses are getting started. A really fine lawn should not contain any clover.

When irrigating it is better to give the lawn a thorough soaking, and not irrigate again until it shows signs of needing water, than to be continually sprinkling.

The seed to be sown is a matter of choice and utility. We recommend sowing a mixture of many different grasses. The high-grade mixtures are mixed according to formulas prepared by men who have made a study of grasses and their uses. They consist of grasses which will make a fine, tough turf, not damaged by tramping, will remain green the entire season, and are of a uniform color. We do not approve of clover in a high-class lawn, although it is desirable when quick ef-

fects are wanted, and in mixing with the hardier grasses.

Old lawns require reseeded about every third year. They should be thoroughly raked, and the soil loosened up as much as possible, about half the quantity of seed sown as is required for a new lawn, and rolled with a heavy roller. It is necessary to reseed for the reason that the grass is mowed, and not allowed to reseed itself, as it would under natural conditions. If the lawn is very weedy, or in bad condition, it is generally best to turn it under and start new.

It never pays to start a lawn by sodding. It is seldom that sod composed of desirable grasses is available, the crevices are apt to

open up and the grass about them die out, and it is never as satisfactory and seldom less expensive than a seeded lawn.

Lawns are frequently disfigured by moles. Rolling will help to drive them away, but the only effective remedy is a mole trap. They generally have a home in some protected place, from which they burrow in various directions. Some of the burrows are used regularly, and some only once. Of course, it would be useless to set a trap on one of the burrows which are used infrequently, and to ascertain which are the little animal's regular highways, press the ridges down in various places, and the next day note which have been again raised.

FRUITS STRAWBERRIES

Strawberries thrive best on light humus-laden soils that have a bountiful water supply and are free from alkali. Planting should be done on the Pacific Slope during the fall, winter or early spring months for best results.

Two general systems of planting and training strawberries are used—the hill system and the matted—row system.

When they are to be grown under the hill system, plants are commonly set 12 to 30 inches apart in the row and all runners removed as they appear. Under the matted row system plants are set from two to three

feet apart and part or all of the runners are allowed to root. The best way is to limit the number of new runner plants, these are spaced from six to eight inches apart. Both systems, however, are dependent upon intensive cultivation for best results, this conserves moisture, aerates the soil and keeps down weeds.

Fertilizer should be used each year to keep up fertility, which besides governing the production of berries keeps the plants in a healthy condition, and helps them ward off diseases and insect pests.

GRAPES

Grapes do best in warm, well-drained soil and should be planted where they will get full sunlight and have the highest temperature about them possible, hence, the south side of a building or wall or the protected sunny slopes.

When a young vine is planted it is cut back to near the ground, only two or three buds being left. After making the first season's growth, it is cut back to one stem which should be left only from six to nine inches long. Some protection from frost should be given during the winter months. Two canes only, are allowed to grow during the second season, and when long enough these should be trellised up. In the spring of the third season the canes or arms as they are now called, are

spread in opposite directions and trellised about 18 inches from the ground and the canes that grow from them are trained upward. The fruit of grape vines is borne near the base of the growing shoot which spring from the wood made the previous year, hence, it is desirable to prune the vine so that strong shoots are procured. The laterals or side shoots should be pinched out and the upright canes kept fastened to the trellis. The ripening depends on the amount of sunshine on the fruit itself.

At the end of each growing season, the canes are cut back to near the arms leaving only one bud on each cane. The two arms should be cut back so that not more than forty or fifty buds are left on each vine from which the fruiting wood will grow the following season.

CURRENTS

By W. S. Thornber, Horticulturist

Soil. Almost any good rich soil of sufficient depth and fertility to produce a good crop of grain will produce crops of currants. While this class of fruit may be grown in hot, dry soil the best results are secured on cool, moist soils. A well-drained, rich, sandy loam with considerable humus in it, or even a clay loam, properly treated, will give excellent results if there is plenty of available plant food. When the soil becomes very hot and dry during the summer it is sometimes advisable to mulch with coarse litter in order to hold the moisture and keep the temperature down. It is difficult, however, to grow good, clean fruit under these conditions. As a plant the currant is a heavy surface feeder and so should receive heavy annual dressings of well rotted manure or a substitute for manure in the form of commercial fertilizers.

Planting. One or two-year-old plants from cuttings or layers give better results for the permanent plantation. Most planters prefer a one-year-old plant, as it is easier to handle than large two-year-old plants.

Early fall planting gives good results where the plants are mulched before the cold weather comes on, but for general planting early spring gives the best results, especially where the stock is secured in the fall or winter and is set out just as soon as the ground is ready to receive the plants in the spring. Late spring planting is not satisfactory since the rootlets and shoots of the currant begin to form early and are easily damaged in handling.

The same care should be exercised as in transplanting a fruit tree. All broken or bruised roots should be removed, the top thinned and cut back and the plant set from one to two inches lower than it stood originally in the nursery.

The square planting plan of 6 x 6 feet is commonly used. However, it does not give sufficient room for the bushy sorts, especially after they begin to bear and the limbs become weighed down with the heavy crops of fruit. A better plan would be to place the rows eight feet apart and the plants six or

even eight feet in the row. This would allow room for thorough cultivation.

Cultivation. If the plantation has received an application of well rotted manure during the winter this should be worked into the soil as early as the ground is ready to work in the spring. This may be done by shallow plowing or deep, double shovel work. After thoroughly working the manure into the soil the surface should be left smooth and as near level as possible. Regular surface cultivation should continue until picking time. After the crop is harvested, the plantation should again be thoroughly cultivated and then the plants permitted to become dormant and ready for winter. Late summer or fall growths should always be discouraged, as there is danger of fall or winter injury resulting from the unripened condition of the shoots.

Pruning. The currant will bear some fruit every year whether it is pruned or not, but, if fine, large fruit is desired, pruning is necessary. There are two general types of training currant plants, i. e., the tree form and the bush form. The tree form is developed by cutting away all the shoots but one and the removal of the lower buds and branches from

this shoot for from twelve to twenty-four inches from the ground, which results in a little tree. This method does very well for the amateur or the novice, but is not practical from a commercial point of view, on account of the unproductiveness of the plant and the danger of a borer destroying a whole plant instead of one cane, as is frequently the case with bush grown plants. The bush form is the more common method used, not only in commercial but in home gardens as well, and results in the development of a well formed bush of from six to eight, two to three-year-old, fruiting canes and from two to four young shoots or one-year-old fruit canes. The common difficulty with the currant bush is that there is too much wood left annually upon the plant and so it is compelled to produce a great number of small berries instead of an equal or greater weight of fine, large fruit. While currant wood will produce fruit for an indefinite period of time, yet after it passes its fourth or fifth year it ceases to be valuable on account of the inferior quality of its fruit. Good, healthy wood produces its best fruit during the second and third years of its life and should be replaced by young shoots before it reaches its fifth year.

GOOSEBERRIES

By W. S. Thornber, Horticulturist

The gooseberry, unlike most American fruits, is sorely neglected here in the west even though very attractive financial returns have been realized from this crop. Two causes are apparent for this neglect—one the difficulty of picking the fruit and the other the almost universal, but erroneous, belief that gooseberries are good only when used in their green state. Rarely or never do we see ripe gooseberries upon the market, yet there is no better fruit grown for canning, spicing and preserving than our large, rich gooseberries.

Both the English and American sorts do well in most sections of the state, but in a few places gooseberry mildew does some damage to some of the English sorts, yet it can be successfully controlled by thorough spraying at the proper season.

Soil. A north or northeasterly slope is better for gooseberries than a southern slope on account of the advantages of late spring, more moisture and a richer, deeper soil. The gooseberry is very partial to a moist, rich, deep soil and prefers a thoroughly enriched, deeply tilled, well drained, strong clay to a light sandy loam. However, it will do very well, even on a gravelly, sandy soil. The general tendency is toward light crops on sandy soils, but the reverse is not always true on heavy clay soils. Gooseberries are especially adapted for the inter-croppage of young orchards since they will cheerfully submit to partial shade, providing it does not become so dense as to seriously encourage the gooseberry mildew.

Planting. One-year-old plants from layer age will give better results than either younger or older plants. A well-rooted plant even though the top is small is far better than a large top with a poor root. The early ripening of the wood in the summer and the long leafless or dormant period preceding winter weather combine in making fall the ideal time to transplant gooseberries. The early shoots and root formation in spring, and the ease with which there are seriously injured makes late spring planting very unwise. If for some reason early fall planting is impossible, then very early spring is the next best time for planting.

The same general care should be used in

transplanting gooseberry plants as is used in the transplanting of larger plants. The roots should be well spread out in a roomy hole and never crammed down in a slit in the ground made with a spade. The soil should be firmed about the roots to prevent drying out and when completed the plant should stand one to two inches deeper than it formerly stood in the nursery.

One of the serious difficulties of most plantations is that they are planted so close together that development of the plant is practically impossible. The square planting plan of 6x6 feet gives very satisfactory results except where the soil gets very dry during the summer and where the heavy annual rainfall produces an abnormally large wood growth. Under such conditions it is better to plant the rows seven or eight feet apart and still maintain the six foot space between the plants in the row.

Cultivation. Gooseberries are shallow rooted plants but very heavy feeders and so must be treated accordingly. Most of our soils need an abundance of well rotted nitrogenous material to make them ideal for this class of fruit. Barnyard manure is one of the essentials for successful culture. The shallow rooting habits of these plants makes deep tillage close to the plants not only impossible but dangerous and should never be practiced after the plant has become established. Just as soon as the ground is dry enough in the spring the plantation should be thoroughly worked with a cultivator or disc, tilling as deep as the roots will permit close to the plants. The subsequent tillage should consist of thoroughly working the surface with a shallow-working tool like an acme, spike tooth or spring tooth cultivator every ten days or two weeks until harvest time and then one or two good cultivations afterwards, when the tillage should cease for the season.

A heavy mulch of rotting straw is a good thing to hold the moisture and keep the soil cool, but attracts field mice and moles so seriously that the station had to dispense with it entirely. As a conserver of moisture clean tillage or the dust mulch is far superior to the straw mulch system.

Pruning. If first-class, fine, large berries are desired the bearing wood of a plant must never be permitted to become old, weak or inactive. The essential thing is to keep the wood vigorous and not permit wood to accumulate in excess of the amount that a plant can thoroughly support. Weak growing plants and shoots should be severely cut back to compel strong growth.

Since it is impracticable to practice regular fruit thinning on gooseberries, a system of thinning when pruning should be practiced. This is accomplished by reducing the number of bearing canes from the large number usu-

ally found to from eight to eighteen, depending entirely upon the vigor of the plant. A shoot should not be permitted to bear more than four crops of fruit, after which its place should be taken by a younger, more profitable cane.

The pruning may be done in the summer after the crop is harvested, but our best results have been secured by very early spring pruning, which produced a more vigorous wood growth than summer pruning and gave better fruiting spurs and wood. Proper pruning does much to simplify picking, and if for no other reason the plants should be thoroughly pruned every year.

LOGANBERRIES, BLACKBERRIES, RASPBERRIES AND DEWBERRIES

By W. S. Thorner, Horticulturist

The soil temperature and general conditions of many parts of the State of Washington are admirably adapted to the commercial growing of practically all kinds of small fruit. This is particularly true of raspberries, blackberries and logan berries. Several localities west of the Cascade mountains have already become famous as berry-growing districts. Probably nowhere in the United States do these fruits grow to a higher degree of perfection than in these districts. With the opening up of large tracts of land for orchard purposes comes the demand for an early yielding, highly profitable crop that can be grown among the trees without danger of injuring them, and so for this reason large acreages of these plants are annually being planted in many parts of the state.

Soil. While raspberries and blackberries are more or less cosmopolitan as to their likes and dislikes of soil, yet they prefer a deep rich, moist (but not wet), sandy loam abundantly supplied with humus and nitrogen plant foods. However, they can be successfully grown on basaltic and volcanic ashy soils after humus has been added, provided there is sufficient moisture during the growing and fruiting season. Some of the soils of the irrigated sections of the state are not adapted to these fruits until one or more crops of green manure have been plowed under.

Drainage. One of the essential features of a good berry soil is thorough drainage, not only during the growing season, but also during the winter months. Soil that becomes saturated with water and remains so for even a short time is not adapted to berry culture and should not be used until artificial drainage has been provided. Much trouble from root rot and root fungus can be avoided by providing good drainage. The factor of air drainage should also be considered in the making of a berry plantation. Good air drainage minimizes the danger of late spring frosts and materially lessens the injuries caused by some of our plant diseases.

Cultivation. Nothing can take the place of good thorough tillage in the berry patch. A heavy mulch may keep down the weeds and hold the moisture, but it does not liberate plant food like cultivation. The spring cultivation should start as soon as the soil is dry enough to be worked and should be deep enough to loosen up the soil, yet not so deep as to injure the feeding roots of the plants. The summer tillage should be shallow but frequent and continue regularly until the crop is safely harvested, and afterwards only frequent enough to maintain growth and keep the suckers and weeds down.

Harvesting and Shipping. The perishable nature of berries make them one of the most difficult fruit crops to market that is commonly grown. However, if they are picked just as they are turning red taken at once just to the packing or cooling shed and handled

with reasonable care they will be in their prime from twelve to twenty-four hours. Berries picked in the morning ship better than those picked in the heat of the day and under no circumstances should fruit be picked when the leaves of the plants are wet with dew or rain.

When berries are not grown in sufficient quantities to warrant the use of refrigerator cars the Pony refrigerators should be used. Over-ripe fruit should be consigned to the cannery and never be permitted to be sent of varieties makes it necessary to use different to distant markets.

Planting Plans. The difference in the growth plans to get the best results for all varieties.

For the convenience of this discussion I group all of these fruits into two classes, i. e.: "Upright Growers," or such plants as produce erect canes, and "Viny Growers," or such plants as the Logan and Phenomenal berries and Evergreen, Himalaya Giant and Early Mammoth Blackberries and Dewberries, which produce long prostrate vines or canes.

The two general planting plans: "Hill" and "Continuous Row" systems are about equally used in the commercial fields of the state. Each has advantages as well as disadvantages and if not crowded will give good results. The Hill system affords the best opportunities for cultivation, air drainage, sunlight on all sides of the plants and ease of harvesting the crop, while the Continuous Row system permits the planting of more plants per acre without serious crowding.

The "Upright Growers" may be profitably planted according to either system, but "Viny Growers" must be grown in hills or they become a dense hedge, making satisfactory harvesting an impossibility.

Planting Distances. The one common fault of practically all amateur fruit growers is the over-planting of their land. The fertility of the soil, annual rainfall or irrigation, and variety materially govern the distance apart plants should be planted. On the rich moist soils of Western Washington where heavy growth is a certainty, or dry soils of Eastern Washington, where the conservation of the moisture, must be practiced, the "Upright Growers" should be planted not closer than six feet apart each way in the Hill system; or three by eight in the "Continuous Row" system. In irrigated sections, where moisture can be supplied at will, the plants may be planted closer. However, it is not advisable, since what may be the additional number of crates per acre is frequently lost by the grade or quality of the fruit. On similar soils the "Viny Growers" should be planted in rows eight feet apart and the plants from sixteen to twenty-four feet apart in the row, using the alternate system and thereby affording a greater feeding area for the roots of each plant.

Training and Staking. The "Upright Growers" where planted in hills can best be staked by a single strong stake from four to six feet in height and the canes loosely but securely fastened to the stake. Some growers prefer to set two stakes about fifteen inches apart at each hill of blackberries with the idea of training the fruiting canes on one and the growing canes on the other. Where the "Upright Growers" are planted in a continuous row they may be trained to and supported by a two-wire trellis consisting of a single row of posts four to five feet high with a single No. 10 wire stapled to the top and another from eighteen to twenty-four inches from the top. The more common method, however, is to set a single line of posts four to five feet high in the row, nail an eighteen-inch cross-arm three feet from the ground and another at the top of the posts, and to the ends of these arms staple heavy wires, thus forming firm lateral supports for the canes.

The four-wire trellis, with the addition of notched cross pieces to lay on the lower wires, makes an excellent support for the "Viny Growers," the purpose being to suspend the growing canes by means of small cloth strings under the upper wires for the first year and at pruning time lower them to rest on the notched pieces on the lower wires for their fruiting period. This makes an easy system to work and keeps the growing and fruiting canes separate, thereby simplifying the picking.

Pruning. In sections where there is danger of winter injury the old fruiting canes should be left until spring, while in other sections they may be removed and the plant cleaned up immediately after they are through fruiting. The cutting back of the tops and final thinning of the canes should be done late in the winter or early in the spring after all danger of winter injury is past. The "Upright Growers" should be cut back to the sound wood from three to five feet in height, while the "Viny Growers" should be cut back to canes from six to twelve feet in length, depending upon their condition and strength.

The number of canes to be left per plant must be determined largely by the variety and the vigor of each plant. Strong, upright plants will support from four to seven canes, while weak ones should not be expected to support more than two or three. Four canes per plant is the most satisfactory number for the "Viny Growers."

PRUNING APPLE TREES

By W. S. Thornber, Horticulturist

In care of the experimental orchard at this station exceptional opportunity is offered for comparative studies of different methods of orchard management which are suggested or used in this and adjoining states. For several years past, the regular pruning of the trees of all ages in this orchard has been planned as to afford a comparison of various methods of summer and winter pruning and various methods of training young trees. The experiments are not yet completed, but certain principles and practices are so clearly superior to all others that a brief popular presentation of them at this time in this bulletin is fully warranted.

Pruning is one of the most important and yet least understood crafts that is practiced in the growing of fruits. There are many erroneous notions and theories practiced every year in the orchards of this state, some of them entirely contrary to nature and the best good of the orchard, while others are vain attempts at securing results that can be easily attained.

Every tree is a rule unto itself and no two trees can always be pruned exactly the same. The pruner should be quick to detect the weak-

nesses as well as the strong marks of a variety or individual. He must be elastic in thought and perception as well as the application, or he will ruin many a valuable tree. His duty is to make the best of every individual tree regardless of its condition or shape.

While it may be possible to grow a successful orchard in some places without pruning, it is an absolutely impossibility here in the West. The successful grower must prune and prune every year at least once if he would have perfect trees.

When to Prune. There can be no best time to prune all varieties and ages of trees in all climates. The vigorous growers and shy bearers on rich moist soil should be summer pruned as well as winter pruned, or at least summer pruned; while the slow growers and heavy bearers should always be pruned during the winter. One must constantly remember that heavy winter pruning tends to exhilarate wood growth, while summer pruning tends to develop fruit buds and consequently fruit.

The essential thing in a young tree is that it makes strong, rapid growth, and so it should be pruned during the dormant or winter season to induce this growth. As soon as it becomes large enough and old enough to bear, this winter pruning may or may not be modified or even supplemented by summer pruning. The essential thing in an old tree is that it produces fruit, and so it should be pruned in such a manner that it will produce fruit. In Eastern Washington and most of the irrigated valleys the trees produce fruit too young and tender to overbear, while in Western Washington the reverse is true. With these facts before us it is easy to see why it is best to prune the young trees and most of the old ones in the central and eastern parts of the state during the winter, and all of the bearing trees in Western Washington during the summer season.

How to Prune. Pruning is an operation that should not be done carelessly or hurriedly. The pruner should study each tree as he prunes it and each branch as he removes it.

When heading back young trees or cutting off the tops of last year's growth out of older trees, the cut should be made slanting away from and about one-sixteenth of an inch above the first bud that is intended to grow. A longer stub than this will dry, crack and form an entrance for fungi, bacteria, etc. A shorter stub will usually result in the death of the first bud.

When pruning trees that have a dense upright habit of growth, like the Wagner, Rome Beauty, etc., cut to strong outer buds in order to spread the naturally narrow, compact top, but when pruning spreading or slender growing trees, cut to buds that point towards the center of the tree in order to throw the limbs inward and upward.

Weak growing trees or weak branches in strong trees may be compelled to produce strong growths by severe winter pruning. In the removal of lateral branches from either young or old trees cut parallel with and close to the main stem. Never leave stubs from one to two inches long in hopes that they will develop into large fruit spurs, since less than 5 per cent ever become fruit spurs and the other 90 per cent die, dry up and leave excellent gateways for the entrance of disease into the wood of the tree. Young lateral branches when shortened back, specially after the spring growth has taken place, very frequently develop fruit buds and spurs.

In the removal of large branches from old or bearing trees always make the cut parallel with the branch or main stem from which the one is removed. This frequently means a larger wound than it would make if the cut is made at right angles to the limb that is to

be removed, but such wounds will heal quicker and are less injurious to the tree than the much smaller ones that leave the collar of the branch to be covered with healing tissue. Do not hesitate to remove large, useless or superfluous limbs from the trees, but always make smooth, clean cuts with a saw, and if necessary to prevent splitting the stem or peeling the bark, make two cuts—the first from 6 to 12 inches out from where the limb is to be finally cut off. Nothing can be applied to the wound to hasten the healing. Wounds an inch or less in diameter need not be treated, while larger wounds may be advantageously treated with a thick coat of lead paint. Cheap mineral paint or tar should not be used upon fruit trees, as it kills the young, tender bark, while grafting waxes crack and peel off before the wound has healed. Any antiseptic that will keep the moisture out makes an excellent coating.

The early training of young trees is very essential, since it is necessary to develop a good frame while they are young if it is ever to be developed. It is almost an impossibility to make a first-class tree out of an old, neglected one. One of the differences between Eastern and Western fruit-growing is in the method of the training of the young trees. In the East the high-headed tree is the rule, while in the West it is the exception. Practical fruit men no longer strive to head their trees high enough for the average horse to work under, but head their trees low and then secure extension tools in order to till all the ground.

The low-headed tree has many advantages over the high-headed tree. As a rule, no apple tree should be permitted to start its head farther than 18 inches from the ground; nor closer than 6 inches from the ground. A tree with more than 18 inches of stem places its fruiting plane almost entirely out of reach of the average man for thinning, harvesting, etc., while the tree with less than 6 inches of stem is very apt to have trunk rot or to readily split when heavily loaded with fruit. If the West desires to continue to lead in the production of fancy and first-class fruit her orchardists must keep the fruit planes of their trees within easy reach of the ground for thinning, spraying and harvesting. Our experiments and observations teach that the following methods give the best results for the training of young apple trees:

First Year. Prune the newly planted one-year-old tree in the spring just before growth begins to a straight whip unless it means the removal of a large number of buds from that part of the stem between 12 and 24 inches from the ground; in the latter case, cut the laterals back to short stubs from one to three buds in length. The smooth pruning gave the best results where it was possible to practice it. After pruning to a whip, cut the top off just above a bud from 18 to 24 inches from the ground. Varieties like the Jonathan may be cut at 18 inches or less, while varieties like the Rome Beauty and Wagner should be headed a little higher. It is frequently difficult to secure sufficient well placed branches upon

a large one-year-old transplanted Wagner if it be cut off closer than 24 inches from the ground. If the lower buds start to grow they should be rubbed off early in July unless the stems of the trees are slender and need to be thickened when the buds should be permitted to grow until August or even the following spring, unless they form very strong growths.

Second Year. Select from three to five of the best placed limbs to become the frame work of the tree, securing as many as possible that point in all directions and that are as far apart on the main stem as possible. Cut off the others close to the main stem and prune the selected ones back to from one-third to one-half of their original length, leaving the most central one as a leader, which should be cut from four to six inches longer than the others. In the case of upright growing varieties prune to outer buds, while in the case of spreading sorts, prune to inner buds and thereby correct the evil. In windy exposures turn as many limbs as possible toward the wind; also prune the branches very severely on the windward side.

Third Year. Select from two to three limbs per branch of the frame, remove the broken, diseased and superfluous branches, and cut the selected ones back to from one-half to two-thirds of their original length. The leader should still be maintained and the top carefully balanced in order to avoid undesirable growth. It is sometimes necessary to remove one or more of the framework branches to open the top. This is always allowable and frequently advantageous in the forming of the top.

Fourth and Fifth Year. Select from one to three limbs per branch that were left the preceding year, remove crossign, diseased and superfluous wood and cut the selected limbs back from one-half to two-thirds of their original length. Thin the top and center as much as possible without leaving it entirely open. In the case of long growths, cut back severely to a branch if possible. In fact, all pruning from now on should be of a thinning and topping nature. In the fourth to fifth year, summer pruning should begin to be practiced in sections west of the Cascades and may be advantageously used with shy or tardy bearers anywhere.

The Pruning of a Bearing Tree. An old apple tree that is in full bearing should be carefully pruned every year. Care should be exercised to keep the top open, balanced, free from crossing or rubbing limbs and from getting too high. A top can be lowered or raised at will if the pruner will study his branches. Always back to a branch, and never leave a long stub unless water sprouts are desired. If the tree has been neglected for years, remove the superfluous wood by degrees about one-third of the total amount to be removed each spring and summer until the desired top is reached. Pruning is a matter of common sense and should be practiced as such. The young tree is elastic and can be easily shaped, while the old tree is established and must be compelled by severe methods.

GRASSES AND CLOVERS

ALFALFA (*Medicago sativa*)

A great essential to the successful growing of Alfalfa is a good subsoil in a condition to be penetrated by the roots in all directions. Does best on soils containing lime and likes clays and loams.

It will not succeed on stiff clay, wet, sour or poorly drained soils. Is deep rooted and once established withstands droughts better than other legumes. It is not sensitive to cold but wet weather is injurious and it does not thrive in districts where the rainfall is over 35 inches unless in a well drained location. Alfalfa is best sown alone. Young plants develop slowly until the root system is well established. Full growth is attained the second year on good soil. It does not cover the soil completely and must be kept free of weeds. When cut the remaining stubble dies and new shoots spring up from the underground crowns. These growing buds sink deeper into the soil each year and this calls for harrowing to break up the clumps.

Growth begins early in the spring, a fortnight earlier than Red Clover. The aftermath grows rapidly and soil and climate being favorable, three or four cuttings per year are made. Alfalfa should not be cut or pastured too close late in the fall as it is injurious to the plants. It should go into winter with a tall stubble. For best quality hay it should be cut when first coming into bloom as the stems become woody immediately after blossoming. Alfalfa hay cut at the right time and properly cured has a very high feeding value, being equal to Wheat Bran in nutritive value.

Inoculation

The failure of alfalfa west of the Cascade Mountains is frequently due to the lack of nitrogen-gathering bacteria in the soil. If the land to be sown has never grown alfalfa before, it is the safest plan to artificially introduce these organisms. This may be done in two ways:

(1) From 300 to 500 pounds of soil, the more the better, may be hauled from a field that has recently produced alfalfa with nodules on the roots, and scattered evenly over the surface of the new field. This should be done just before the alfalfa seed is sown and the soil should be thoroughly mixed with that of the new field by harrowing or discing. It is quite expensive to inoculate large fields in this way and there is always a possibility of transferring plant diseases from one field to another.

Of scarcely less importance is the danger of disseminating noxious weeds and insect pests through this plan of inoculating by means of natural soils. Even though weeds may not have been serious in the first field, the great number of dormant seeds requiring but a slight change in surroundings to produce germination is always a menace. If soil is to be used, however, whether obtained from nearby fields or shipped long distances, the evidence should be clear that the soil is free from the objections mentioned above.

(2) Pure cultures of the proper bacteria may be used. The Bureau of Plant Industry of the United States Department of Agriculture has isolated the different organisms for the different legumes, is growing them in pure cultures, and furnishes them to farmers whose soil conditions seem to indicate that inoculation is necessary.

Those desiring inoculating material should write to Soil Bacteriology Investigations, Bureau of Plant Industry, Washington, D. C., for an application blank. To avoid delays, requests should be on file several weeks before

the material is to be used.

Should weeds tend to crowd out the alfalfa during the first year, they should be mown often enough to hold them in check. The cutter bar of the mower should be set about five inches high in order that the young alfalfa plants may not be cut too closely. If the crop mowed would be sufficient when dry to make a third of a ton or more of hay (and dried weeds) to the acre, which it usually will be in spots, it should be removed from the field; if less than this it may be permitted to lie where it is cut.

Methods of Sowing

This must be governed largely by local conditions. Land that is naturally well drained or that is tilled at least three feet deep should be selected for this crop. If barnyard manure is available, put on from 12 to 20 tons per acre in the fall and plow it under 8 to 10 inches deep. In the spring, when the land is in good working condition, cut it up thoroughly with a disc harrow and work it down fine. Let it lie for a week or ten days; then give a good harrowing so as to destroy all weeds. Sow about 12 pounds of clean seed per acre and cover with a harrow. If the soil is inclined to be dry, finish with a roller. About the time the seed is sown, put on 70 to 100 pounds of land plaster to the acre.

ALSIKE (*Trifolium hybridum*)

By Byron Hunter

Alsike clover (*Trifolium hybridum*) has a much wider range of adaptability in Western Oregon and Western Washington than red clover. Its stems are much finer and more recumbent than those of red clover, and its leaves are not so numerous. The yield of the first crop is very satisfactory but it is disposed to make but little growth after a crop has fully matured for hay. If cut early, however, it is said to make a very satisfactory second growth. A delay of only a few days in the time of cutting the first crop makes a very marked difference in the growth of the second.

Alsike clover makes a very good quality of hay and is well suited to sow with timothy, since these two crops mature at the same time. It is a perennial, stands grazing well, and seems to be much less susceptible to the attacks of the clover root borer than is red clover. Since alsike clover is so nearly the equal of red clover in nearly every way it should be given a thorough trial in all localities west of the Cascade Mountains where red clover may have failed.

From what has been said it is evident that alsike clover is eminently adapted for sowing on land that is too cold and wet for red clover, in mixtures for permanent pastures, and on forest burns and burnt slashings that are to be used for pasture for several years.

The seed of alsike clover is quite small and 5 or 6 pounds per acre will be found sufficient when it is sown alone. With this exception, all that has been said regarding the seeding of red clover applies equally well to alsike clover.

BERMUDA GRASS (*Cynodon dactylon*)

A most valuable grass for our southern states, both for pasture and lawn. It is of dwarf habit, with long creeping stems, rooting at the joints and covering the ground with a mat of fine turf, which no amount of tramping can destroy. As it cannot endure frost, it is of no value north of California. It thrives in the poorest and sandiest soil, and resists extreme drought and the most intense heat.

GRIMM ALFALFA (*Medicago media*)

Undoubtedly this variety has in recent years

attracted the attention of Alfalfa growers more than any other variety. The origin of this type is the result of cross hybridizing of the blue flowered species with the yellow flowered. Grimm belongs to the "variegated" class and has a more branching root system which may possibly account for it being hardier than the "blue flowered" (*Medicago sativa*) varieties.

Extract from United States Government Bulletin No. 209:

"The Grimm Alfalfa is much hardier than the ordinary kinds obtained from Kansas, Utah and elsewhere, and there is even strong reason to believe that it is the hardiest known form of the cultivated plant. It not only endures extremely low temperatures with or without snow and other adverse conditions, but it can be cut with greater safety late in the Fall and will bear more abuse in the way of pasturage than any other plant that has been compared with it until this time. There is some disagreement among investigators as to how Grimm Alfalfa obtained its hardness, but there is no difference of opinion that it is hardy."

Culture same as ordinary Alfalfa.

BLUE GRASS CANADIAN (*Poa compressa*)

Many people have a wrong idea in regard to Canadian Blue Grass, thinking that it is the same thing as Kentucky Blue Grass, only grown in Canada instead of in Kentucky. Others think that it is a worthless grass.

Canadian Blue Grass is of the same general family as Kentucky Blue Grass, only it is somewhat different in habit of growth and in texture. The seed is almost identical with Kentucky Blue Grass—in fact one cannot tell the difference without a good glass. It is coarse and has a larger leaf that Kentucky Blue Grass and in a good many instances is more valuable. It makes an exceedingly strong turf, as it has extensive creeping root stocks. It is a more decided blue in color, has strongly flattened stem and lower habit of growth, and will grow in a great many varieties of soil and in many places where Kentucky Blue Grass will not thrive.

It is particularly valuable on thin or poor land or dry soil, of course making a better yield on good land. It makes a valuable addition to dairy pastures as cows feeding on it yield the richest milk and finest butter. It grows sufficiently tall for hay, and as it is a hard grass and shrinks very little in drying, the hay is heavy in proportion to its bulk. It should be more largely used than it is, as it is well adapted to the gravelly land of Western Washington and Oregon. The seed is generally very reasonable in price. For pasture sow about 20 pounds to the acre and for lawns 1 pound to about 300 square feet.

BLUE GRASS, KENTUCKY (*Poa pratensis*)

Kentucky Blue Grass is one of the best known lawn grasses and is also valuable in the pasture lands of Western Washington and Oregon. In making a lawn Kentucky Blue Grass makes a good firm sod and can be sown either alone or in a mixture with other grass. It grows slowly at the start and there is, therefore, an advantage in mixing it with other quicker growing grasses. It is rather a shallow rooter and on lawns that are made on gravelly soil, high and dry, it is best to have some other grass with it. Many of the imported grasses, such as fine-leaved Fescue, and Creeping Bent, mixed with Kentucky Blue Grass, add very much to the beauty of the lawn. Kentucky Blue Grass and White Clover can be sown together in about two-thirds of Blue grass to one-third of White Clover. The clover will come up quickly, making a fairly good lawn the first year and will protect the Blue Grass. After a year or so the Blue Grass will develop a solid turf

and will gradually clean out the White Clover, leaving a pure Blue Grass lawn. For lawn purposes it requires about 1 pound of seed to 300 square feet, and the heavier the sowing the better lawn will be produced. Remember that in sowing a lawn the weeds and grass which you spade under stand a good deal better chance of growing than the seed which you are sowing, and it will, therefore, pay you to keep the ground sprinkled and cultivated several months before sowing the lawn, thus getting rid of a good proportion of weeds that are in the soil. This is easier than pulling them out of the lawn afterwards. Blue Grass should be covered only very lightly. If buried too deeply it will not come up. The best way is to rake the ground, sow the seed on a very quiet day when the wind is not blowing, and then roll the ground. The rolling will cover the seed sufficiently without any breaking. If the seed is sown during the hot summer months it will be necessary to shade the ground somewhat with brush or excelsior. Do not use straw or hay that contains too many weed seeds. Kentucky Blue Grass for pasture should be sown about 20 pounds to the acre. We would not recommend sowing it alone, but it is a very useful addition to pasture mixture.

BROME GRASS—*Bromus inermis*

Also known as Smooth Brome Grass and Russian Brome Grass.

This has been highly praised and exploited during the last few years, and for certain locations it is certainly a very valuable grass, but we would not advise using it in Western Washington, or Western Oregon, as there are a number of other grasses that are more useful. In the semi-arid regions of the Northwest it is a very useful grass as it requires but little moisture and quickly makes a thick, firm turf. It seems to stand an almost unlimited amount of dry weather and it thrives well on dry, loose soils, but of course will give a greater yield on better soils. It is not as high in feeding value as many other grasses and is somewhat difficult to eradicate when once established. It makes a fairly good pasture and grows tall enough to cut for hay. Sow 35 to 40 pounds per acre.

CLOVER, CRIMSON (*Trifolium incarnatum*)

Crimson Clover is an annual, useful principally as a cover crop to prevent winter rains washing the land. It does not succeed well north of Portland, but can be grown fairly well in Willamette Valley and very successfully in California. However, we have some other plants that are more successful, as, for instance, the vetches, which make a larger growth, are easier to start and which are cheap, so that we do not advise the planting of Crimson Clover on the Pacific Coast, except in rare instances.

CLOVER, MAMMOTH RED

(*Trifolium medium*)

This variety grows five or six feet high, is so coarse that it is of little use for forage, and is used almost exclusively as a soiling crop, to be plowed under for which purpose it is valuable on account of its deep-rooting habits and its ability, as with other legumes, of drawing nitrogen from the atmosphere and distributing it in the soil. Sow 12 to 20 pounds to the acre.

RED CLOVER (*Trifolium medium*)

Generally speaking, red clover reaches its highest development in the western portion of Oregon and Washington, where, under favorable conditions, it may be cut three times during the year. The first crop should be cut for hay or ensilage early in June, the second for hay in August and the third for ensilage or green feeding late in the fall. Red Clover is sometimes hard to establish on soils that have produced cereal crops exclusively for several years. This is possibly due to the method of seeding or the texture of the soil, but prob-

ably to the lack of nodule-forming bacteria.

Red Clover can be sown either in the spring or fall and generally does best with a grain crop that is not too thick, although it may be sown alone in the late summer or early autumn. This method is seldom used but is probably one of the most satisfactory ways of seeding west of the Cascade Mountains.

The soil should be well prepared and the seed must not be covered too deeply although it must be in firm contact with the soil. Therefore, light loams or loose soils should be parked or rolled so as to keep the moisture in them available to the young clover plants at all times.

Red Clover is well suited to be sown with Timothy for hay crop and should be in all hay and pasture mixtures. It is often sown alone especially in sections where the conditions are favorable to seed production.

Since the first crop of clover is seldom used for seed it is cut for hay or ensilage about June first to enable the second crop to make a good growth before the dry season begins. Instead of cutting the first crop for hay or ensilage it is often pastured until late in May, and the following crop is then left for seed, mowing, however, causes the following crop to come on more evenly than pasturing.

Red Clover hay is relished by cattle and sheep. Its protein content is very high making it an especially valuable feed for dairy cows.

Sow 10 to 15 pounds of seed per acre and cover lightly.

WHITE SWEET CLOVER (*Melilotus alba*) (Bokhara)

An erect, branched, stemmy, biennial plant with uniform, ascending stems not thickly supplied with leaves. During its second season it makes a growth of from five to twelve feet, produces numerous flowers, and dies when it has matured its seed. The first season it makes a growth of eighteen to thirty inches and in addition stores up a very large root reserve food, material for a rapid and vigorous growth early the following season. When young the plant resembles alfalfa, but can readily be distinguished by the bitter taste of its foliage. When in bloom it can easily be identified by the long, loose racemes of white flowers and its open coarser growth. Unlike alfalfa, the seeds are borne singly in each pod. In common with other legumes it possesses the power of storing up nitrogen in the nodules on its roots, thus adding one important element of soil fertility to the land.

YELLOW ANNUAL SWEET CLOVER (*Melilotus indica*)

This small yellow blossomed species is a low-growing, erect, early-flowering plant. It is an annual, while the white variety is a biennial. It makes a slower growth than the white variety, and is not considered so valuable.

CLOVER, WHITE (*Trifolium repens*)

This is also called White Dutch Clover. It is a perennial plant, making growth of from four to ten inches, according to the land on which it is planted. It is an excellent plant for lawns as it will grow under almost any conditions, is easy to start and will make a nice lawn within six weeks from the time of planting. It will grow on almost any kind of soil and in the deep shade or the brightest sunshine. In sowing lawns it is always advisable to use grass seeds with the white clover, as after about two years the clover will become ragged if sown alone. White clover is also excellent for pastures, especially in Western Oregon and the Puget Sound region. It produces a forage that is well liked by all stock, is sweet, very nutritious and makes lots of milk. For pastures it should

be sown at the rate of 6 to 8 pounds to the acre in addition to other grasses. It makes a good mixture with Italian Rye Grass, Orchard Grass and Red Top. In sowing large lawns or parks use from 25 to 100 pounds per acre. The more seed the better the turf and finer lawn you will have.

CREEPING BENT, or FLORIN (*Agrostis stolonifera*)

The distinctive feature of this species is its compact, creeping, rooting stems. Although it prefers a moist soil it will stand considerable drought. It is of rapid growth and spreading habit, forming a strong and enduring turf that is positively improved by constant tramping, which together with its fine texture and deep green colors, makes it one of the very best lawn grasses. It is included in all of the best lawn mixtures. Also very valuable in pasture mixtures. Height 20 to 25 inches. If sown alone use about 50 pounds to the acre.

CRESTED DOG'S TAIL (*Cynosurus cristatus*)

A very hardy perennial grass with stoloniferous root stocks, thriving on either good soil or poor light soil and hillsides, or in shade. It is a valuable grass in pasture or lawn mixtures, and is especially relished by sheep. Should be used in mixtures only. Sow at the rate of twenty-five pounds per acre if sown alone, or in that proportion if mixed with other seeds.

FINE-LEAVED FESCUE (*Festuca tenuifolia*)

Grows only 15 to 20 inches high, in small tufts, with few stems, but a large amount of bottom foliage. It will grow on very dry and inferior soils, and its dwarf habit and fineness of leaf render it not unsuitable for dry slopes on lawns. Sow 30 pounds to the acre.

HARD FESCUE (*Festuca duriuscula*)

This is a variety of *Festuca ovina*, dwarfer and less vigorous in growth. It is emphatically a grass for dry lands, doing well on sandy and shallow silicious soils. For permanent pastures on poor lands it is especially valuable; may also be used in meadow mixtures, for well manured clay soils. Not recommended for lawns. Height 1 to 2 feet. Sow 30 pounds to the acre.

JOHNSON GRASS (*Sorghum halepense*)

A perennial of luxuriant growth. Has strong roots that penetrate to a considerable depth, enabling it to stand a hot dry climate. It belongs to the Sorghum family and is sweet and nutritious and much relished by stock. Is of no use in the Northwest, and its sale is prohibited in California, on account of its spreading habit and the difficulty of eradicating it.

MEADOW FESCUE (*Festuca pratensis*)

By Byron Hunter

Although meadow fescue (*Festuca pratensis*) is grown but little west of the Cascade Mountains, it is highly prized by those who know it. Like orchard grass, it is adapted to practically all of the tillable soils of the region except those that are gravelly or very wet. It is a perennial; lasts much better than timothy; is relished by all kinds of stock; makes a good quality of hay; and, when once established, stands tramping and grazing well. It does not begin to grow so early in the spring as orchard grass, but remains green during the summer and makes a good growth during the fall. It is especially adapted to a place in meadow and pasture mixtures that are to occupy the land for a number of years. One of the leading dairymen of the Willamette Valley sows the following mixture in the spring: Meadow fescue, 10 pounds; English rye-grass, 10 pounds; timothy, 4 pounds; red clover, 4 pounds, and alsike clover, 2 pounds. This mixture is used for hay for two years, and then for pasture three years. Of the grasses in this mixture, meadow fescue is his favorite.

Meadow fescue may be sown in the early fall or spring. When sown alone, from 15 to 20 pounds per acre of the best seed should be used.

MESQUITE—MEADOW SOFT GRASS or VELVET GRASS (*Holcus lanatus*)

Of little agricultural value, except for pastures on light sandy or marshy soil where other grasses will not thrive. It is not relished by stock, and on account of its spreading habit and difficult eradication is liable to become a nuisance.

OAT GRASS, TALL (*Avena elatior*)

This is a perennial species which grows in loose tufts and throws up an abundance of leaves and tall stalks. It is well adapted to rich, upland soils, and when once well established is one of the best drought-resistant cultivated grasses. In Iowa and California its cultivation has been especially recommended on account of its ability to live through the hottest and driest seasons; but while valuable in mixtures it is not suitable to plant alone unless grown for seed. The forage is bitter, and when green is not readily eaten by cattle, except where it occurs in small quantities mixed with other grasses. The hay, however, is of fine quality and is relished by stock. It blooms early, and should be cut as soon as the first blooms appear, because after flowering the stems become hard, woody, and indigestible. It is a deep-rooted grass, and requires deep and thorough preparation of the soil. Like alfalfa it is quickly killed by standing water or bad drainage. It makes its heaviest growth the second year, and thrives better on southern exposure than on cold northern ones. It may be sown alone or in mixture with other grasses. In mixtures the quantity of tall oat grass should not exceed one-fifth of the total amount sown. The seed weighs about 10 pounds to the bushel.

ORCHARD GRASS (*Dactylis glomerata*)

Orchard grass (*Dactylis glomerata*) thrives remarkably well on all tillable soils west of the Cascade Mountains, except those that are very wet. It is the earliest grass to start to grow in the spring; it revives quickly after it is cropped by stock or cut for hay, especially if the soil is moist; it remains green during the summer and fall, and is relished fairly well by all kinds of stock; it stands grazing and tramping much better than timothy, and lasts for a number of years when given proper care. It is, therefore, eminently adapted for pasture purposes and should form an important part of every permanent pasture mixture.

Orchard grass makes an excellent quality of hay if cut before or just after the blooming period. If the cutting is delayed but a few days beyond this period orchard grass has a strong tendency to become woody, and the hay is then of poor quality. It ripens with red clover, and under favorable circumstances it may be cut twice during a season. It is, therefore, especially well fitted for sowing with red clover when intended for hay. It grows in bunches and does not make a smooth sod; for this reason it is seldom sown alone. Orchard grass is a little early, and is often ready to cut before good haying weather has begun. This fact and its tendency to become woody immediately after blooming are the chief drawbacks to its culture west of the Cascade Mountains. Its earliness is an advantage, however, when it is used for ensilage or soiling.

The seed habits of orchard grass are very satisfactory, and the yield is from 15 to 18 bushels of seed per acre. The seed weighs from 14 to 18 pounds per bushel. When sown alone 20 to 25 pounds of seed per acre will be sufficient. It is sown either in the fall or

spring. If sown in the early fall, without a nurse crop, it should make an excellent crop the next year.

RED, or CREEPING FESCUE (*Festuca rubra*)

A creeping rooted species, forming a close and lasting turf. It resists extreme drought, and thrives on very inferior soils, gravelly banks and exposed hillsides. Valuable for binding shifting sands and for shady places in lawns. Grows 25 to 30 inches high. Sow 30 pounds to the acre.

RED TOP (*Agrostis vulgaris*)

This grass is a native, ranging across the northern portion of the continent. In the North it is the standard grass for wet meadows. It has been determined as a result of experiments, notably at the Rhode Island Experiment Station, that red top makes its best growth on sour soils; in other words, on soils showing a distinctly acid reaction. Red Top grows naturally on marshy meadows and is best suited for cultivation in such places. While the application of lime is often recommended as an improving preliminary treatment of land which is to be seeded down to meadow grasses, it has been found that red top is an exception, and will not make a favorable growth upon soils which are neutral or alkaline.

There are a great number of forms or varieties, which differ in height, leafage, and the manner of growth, so that great variability may be expected. Opinions differ widely in regard to its value because of this diversity of forms. It is a perennial, provided with long creeping stems and underground runners, and is one of the best bottom grasses, bearing large numbers of fine root leaves. Because of this and its creeping habit of growth it is one of the best grasses to use in mixtures with erect tufted species such as orchard grass and timothy, filling in between the clumps and producing a continuous turf. The weight of the seed varies according to the quality from 8 to 30 pounds to the bushel, averaging perhaps not more than 10 or 12. Mixtures of red top and alsike clover are largely used for low, wet meadow lands and pastures. The creeping habit of this grass makes it less liable to injury from trampling by stock than is the case with the tufted, bunchy grasses.

Red top, or certain forms of it, sometimes becomes a bad weed in cultivated land, because of its tendency to form stolons or creeping root-stocks, which are as difficult to entirely remove as are those of quack grass. In Scotland and the Norwegian countries red top is placed in the same category as quack grass as a weedy pest, especially on cold, marshy soils; but it is to be remembered that it does not thrive on alkaline soil, and so may be destroyed by the application of lime to the land, changing the soil from acid to alkaline.

REED CANARY GRASS

(*Phalaris arundinacea*)

A very hardy perennial, preferring stiff, wet land. Grows well in ditches and by riversides, where its long creeping rootstalks render it valuable for binding the banks. Its seed affords food for trout and wild fowl. When young it may be cut for green forage for cattle. One of the very few grasses that will live on overflowed land. Grows six feet high. Sow 40 pounds to the acre.

RYE GRASS, PERENNIAL (*Lolium perenne*)

Very generally known as English Rye Grass. Also the same thing grown largely in Australia and known to the trade as Australian Rye Grass. It has been very largely used on the Pacific Coast, especially during the last few years, and for the territory west of the Cascade Mountains is an exceedingly valuable

plant, as the climate there is especially well adapted to its growth. It prefers a moist and rich loam or clay but will grow and do well in almost any locality and almost any kind of soil. It is better used in a mixture with other grasses and it produces both hay and pasture, as the grass is of high feeding value. It should be sown about 30 pounds to the acre when sown alone or the same proportion with other grasses.

RYE GRASS ITALIAN (*Lolium Italicum*)

This grass is only supposed to live about two seasons, but in Western Washington and Western Oregon it will re-seed itself and will last almost indefinitely. We consider it one of the most valuable pasture grasses for the Pacific Coast, as it makes a quantity of green feed late in the season after the other grasses are past their prime. After being cut down it makes a very rapid growth and will produce more green pasture in mid-summer than any other grass we know of.

In Europe it is considered as an excellent hay grass and produces a dense turf and is well liked by all kinds of stock. It is one of the best grasses for soiling. Should be sown about 30 pounds to the acre. Is a valuable grass for sowing on logged-off lands or burns and may be planted either in the fall or spring.

SHEEP'S FESCUE (*Festuca ovina*)

Grows 20 to 25 inches high, prefers dry uplands, and thrives in poor, shallow, gravelly soils where other grasses would fail. It is very hardy, resisting extreme heat and cold. Though of dwarf growth, it grows thickly, yielding a large amount of very nutritious herbage, which is much relished by sheep. In grass mixtures for pastures on high and dry lands it is especially valuable. Though a "bunch grass," it may be included in lawn mixtures on account of its fine foliage and dwarf, dense growth. Sow 35 pounds to the acre.

SUDAN GRASS (*Andropogon Sorghum*)

Sudan Grass was introduced from Egypt by the U. S. Department of Agriculture. It is recommended for hot, dry climates, but has been grown quite successfully west of the Cascade Mountains. It is an annual, and like millet, sorghum, etc., the seed must be sown each spring. In appearance it is similar to Johnson Grass, but differs in being an annual, does not have creeping root stocks, and is not difficult to eradicate.

It is sensitive to frost, and seed should not be sown until all danger of frost is past. It may be sown in rows and cultivated, in which case it grows six to nine feet high, and only six to seven pounds of seed is required for an acre; or it may be sown broadcast, requiring sixteen to twenty-four pounds of seed per acre, and growing four to six feet high.

The stems are small and leafy and it makes excellent hay, greedily eaten by all kinds of stock. It yields one to two tons of hay at each cutting and from two to four cuttings may be had in one season. It should be cut as soon as the grass is full headed. It is also good for silage and for feeding green.

SWEET VERNAL, True Perennial (*Anthoxanthum odoratum*)

For a mixture with pasture grasses, it is valuable on account of its vernal growth, and also for continuing to throw up root foliage until late in the Fall. For meadow its chief

merit is the fragrant odor, sweetening the hay. It is a condiment, rather than a grass of much nutritive value. Sow 2 to 3 pounds to the acre with other seeds.

SWEET VERNAL, Annual (*Anthoxanthum odoratum*, Puelii)

An annual, entirely distinct from the perennial. Of little agricultural value.

TIMOTHY

By Byron Hunter

Timothy (*Phleum pratense*) is the standard grass in Oregon and Washington west of the Cascade Mountains. It is shallow rooted and naturally adapted to moist lands. But the abundant rainfall of this region, distributed as it is through so many months of the year, makes it possible for it to succeed on practically all classes of soils except sands and gravels. There are individual farmers who like other grasses better, but timothy is the one grass that is universally known and grown. It has been the standard market hay so long and has so many valuable characteristics that it will require years for any other grass, even with superior qualities, to become as popular as timothy in this region.

There are many reasons why timothy enjoys this popularity. It has the best seed habits of any of our cultivated grasses. The seed is usually cheap; has a very high percentage of germination when properly matured, is easily harvested, and retains its vitality remarkably well. The hay is easily cured, stands handling well, and is relished by all kinds of stock. Unlike many other grasses, a few days' delay in the time of cutting makes but little difference in the quality of the hay—a very important point in a region where showers are not infrequent during the haying season.

West of the Cascade Mountains timothy is most frequently grown with winter wheat and the clover added in the spring, during February or March, when the ground is thawing and freezing. Another method is to prepare the ground in the spring and sow the timothy and clover with or without a nurse crop. Still another way is to sow the clover in the spring with a nurse crop and in September, after the grain has been harvested, sow the timothy on the stubble. When sown with a nurse crop, timothy and clover are shaded too much, especially if the nurse crop is allowed to mature for grain, and unsatisfactory stands are often obtained in this way. Perhaps the most satisfactory way of sowing both timothy and clover is to sow them without a nurse crop in the late summer or early fall on land that is as free as possible from weeds. Good stands are secured in this way, and they give excellent yields the first year. Timothy is two or three weeks later than red clover, and when they are grown together for hay either the timothy must be cut a little immature or the clover allowed to become too ripe. For this reason some other grasses are better suited than timothy for sowing with red clover. When sown alone from 6 to 10 pounds of timothy seed per acre are sufficient. For a seed crop timothy yields much better when the stand is comparatively thin. A much finer quality of hay is produced when it is thick. It is the general rule to cut timothy for hay just at the end of the blooming period. Cattle prefer the hay when cut at this stage, while horses seem to relish it better if it is a little more mature.

SEEDING BURNS AND SLASHINGS

By Byron Hunter.

Dense forests of evergreen timber cover a very large portion of Western Oregon and Western Washington. During the dry season of the year forest fires overrun large areas, killing practically all vegetation, and leaving a loose blanket of ashes on the surface of the ground. These burnt areas if left unmolested for a few years usually produce a dense growth of young trees and brush and are practically worthless for grazing purposes. In clearing land it also frequently happens that the timber and brush are slashed and burnt several years before the stumps are removed. By properly seeding these burnt areas they may be made to produce excellent pasture. Since the stumps are in the ground and there is therefore no chance to cover the seed, the seeding should always be done in the fall before the ashes have settled. The first rain

that comes will then cover the seed sufficiently to insure good germination.

Since there is little chance to improve or renew the stand on account of the stumps and timber remaining on the land, only seed of those plants should be sown that last a long time, stand close cropping, and yet produce as much growth as possible. If the seed is sown in the unsettled ashes as indicated, little difficulty will be experienced in getting good stands of white clover, alsike clover, red clover, orchard grass, meadow fescue, timothy, and English rye-grass. A mixture of 1 pound of white clover, 3 pounds of alsike clover, 10 of orchard grass, and 10 pounds of meadow fescue per acre should give satisfactory results when sown in the unsettled ashes in the early fall. Timothy will also do well for this purpose.

GRAIN AND FORAGE CROPS

OATS

By Prof. E. F. Gaines

The oat plant grows along at a moderate rate until it begins to head out, then doubles its length and rushes to maturity in less time than any of the other cereals. It has a vigorous, spreading root system, and will do better on sod or newly cleared land than either wheat or barley. It is best to fall plow, then disk in spring and seed with a drill. Oats may be broadcasted with better results than wheat or barley. Some farmers sow them on stubble land and then plow them under, but this is not considered advisable, for oats will respond to thorough seed bed preparation by increased yields which will well pay for the extra labor. Oats cannot be grown in arid sections where wheat and rye will still produce a crop.

Four to six pecks (40 to 60 pounds) of seed per acre will produce more grain on the drier uplands than heavier seeding, but eight to ten pecks (80 to 100 pounds) may be used with profit on the bottom lands. Where the season is shortened, either by cold or drought, the early varieties such as Sixty Day or Kherson will give the largest returns. The later varieties such as Swedish Select or Abundance produce the heaviest crops on the bottom lands. Oats are considered the standard grain for horses the world over, and oat hay is excellent for all stock.

OATS WITH PEAS OR VETCH

By Alf. Christianson

Oats is considered the best grain to sow with peas or vetch for green feed, ensilage or hay. They may also be left to ripen and the oats can easily be separated from the peas. Some farmers who have tried growing peas mixed with oats claim that under certain conditions and on some soils they get a better crop than by growing peas alone. However, the principal reason for mixing them is to form a support for the peas so that they will stand up better and can be more easily cut with the mower, and when used for green feed or ensilage they make a more correctly balanced food.

The proportions of seed to sow depends upon what the crop is to be used for and the condition of the soil. If for grain on bottom land, about eighty pounds of peas and sixty pounds of oats per acre should be sown. If to be used for green feed or ensilage the peas and oats should be sown in equal quantities. When vetch is sown with oats, not more than fifty pounds of vetch should be used per acre.

CORN

By Prof. E. F. Gaines

Corn requires more time to mature than wheat, oats, or barley. The greatest danger is from cold weather and frosts. The corn plant develops a great number of small fibrous roots just below the surface of the ground which spread in all directions for several feet. Because of this habit corn should be laid by when it is two feet high and the last cultivation should be rather shallow, not to exceed three or four inches.

The field for corn should be plowed in late fall, about eight inches deep, and left rough. If it is not possible to fall plow, early spring plowing should be somewhat shallower and should be harrowed at once. Just before planting, a seed bed should be prepared with disk and harrow to a depth of about three inches. It is important to do this just before planting to give the corn an even start with the weeds.

Corn should not be planted until the ground begins to get warm. The average date to plant is May 10th. This may vary from April 15th to June 1st in different sections of the Northwest. For silage some prefer to drill the seed in rows $3\frac{1}{2}$ feet apart with plants 8 to 15 inches apart in the row. Better cultivation can be given if the corn is planted in hills $3\frac{1}{2}$ feet apart each way. For seed production there should not be over two or three stalks in a hill.

It is important to use only home grown seed, as seed from Illinois or Missouri either will not mature or will produce an inferior yield.

The corn field may be harrowed once or twice before the corn is large enough to cultivate. This will keep the soil loose and kill small weeds as they are coming up, and will reduce the number of cultivations required.

Corn is raised in the Northwest primarily for silage, but it may be shocked and fed as fodder or cribbed and fed as grain in the sections of longer seasonal growth.

WHEAT

By Prof. E. F. Gaines

Wheat is the standard grain crop of the Northwest. It is grown under wide variations of temperature, elevation and rainfall. Fall wheat should be drilled in at the rate of from three to six pecks (45 to 90 pounds) per acre on a rather loose cloddy seed bed. Spring wheat does better when drilled in early on a seed bed that is rather firm below the first two or three inches. Harrowing wheat is of doubtful value unless the ground is badly

crusted or foul with mustard or other weeds.

There are fifty or more varieties of wheat grown in the Northwest, but most of them are inferior and should be discarded. The country seems to be in a transition stage just now as is shown by the introduction and sudden popularity of several new strains as Marquis (hard red spring), Early Baart (soft white spring), and some of the Club Hybrids. As a rule, winter wheat yields more than spring wheat. For silage or hay wheat should be cut in the dough stage, but for grain it should be well matured.

RYE IN WESTERN WASHINGTON

By Prof. E. B. Stockey

Rye is often considered as a last resort crop to be grown on soils too poor to grow anything else. It is always a vigorous growing crop and in this section is at its best. The large amount of growth it will produce and the many uses to which it can be put are causing it to be more widely grown in Western Washington each year.

Rye is adapted to a wide range of soils, but like most other crops does best on the more fertile areas. It is well suited to Western Washington generally and one trial will usually show it to have some place in the cropping scheme. There are very few farms where it will occupy a prominent place but on many farms it will be found to have considerable merit.

Fall and early spring pasture. Fall-seeded rye can often be pastured without injury to the crop if the soil is not injured by pasturing and if it is not pastured too close. If a crop is expected from the rye it should not be pastured after it starts to joint. Where the rye is to be used primarily for pasture on the better soils one or two pounds of Dwarf Essex Rape to the acre will add to the value of the pasture, but on ordinary upland soils it will not be of much value. Rye should be seeded a little heavier for pasture than for other purposes. Seeded between the corn rows just previous to the last cultivation, rye will afford considerable pasture after the corn is harvested.

Grain. Rye is not yet raised to any extent in Western Washington for grain, but some sections are beginning to grow it for that purpose. Where more rye is grown than is needed for other purposes it may very well be left for seed.

Varieties of rye are not very distinct, but there are varieties of both the fall or winter and spring types. The winter varieties are the only ones that are much used in Western Washington.

Seeding. The rate of seeding varies from one and one-half to three and one-half bushels (84 to 196 lbs.) per acre. Generally speaking, the more fertile the soil the heavier the seeding. On some of the upland one and one-half bushels (84 lbs.) is a great plenty, and on the heavier, more fertile bottom land heavier seeding may well be used, particularly if the seed is quite large.

EMMER

By Prof. E. F. Gaines.

Emmer is a variety of wheat which retains the hull when threshed. It is considered more hardy than other varieties of wheat, but it is not grown much commercially. The same cultural practices may be used for emmer that are used for wheat. The crop is of questionable value and will probably not increase in popularity.

BARLEY

By Prof. E. F. Gaines.

Barley may be planted either in fall or spring. It winter kills more easily than wheat, however. The straw is somewhat weaker than that of wheat or oats and for that reason it is liable to lodge when seeded on moist rich

bottom lands. On the average it yields three hundred pounds more per acre than wheat and two hundred and sixty-four pounds more than oats. The counties of greatest barley production in Washington are Columbia, Garfield, Whitman, Lincoln and Walla Walla, ranking in the order named.

For winter barley, plow seven inches deep and drill in without working the soil, as a rough winter surface holds the moisture better than a thoroughly pulverized one and it will not run together so with the winter storms. For spring barley the soil should be plowed in the late fall or early spring, six to eight inches deep, and a good seed bed prepared by harrowing or disking till the surface is loose but the sub-surface down two or three inches is reasonably firm. Spring barley should be seeded as early as the ground is fit to work. This varies from the middle of February for the drier uplands to May 1st in the wetter lowlands. One bushel (48 lbs.) per acre is sufficient to sow in the drier sections of the Northwest, but as much as two bushels (96 lbs.) should be seeded in the fertile lowlands of the coast. The six-row bearded varieties yield the most grain, but for hay or for hogging off the Nepal or beardless varieties are more satisfactory.

Barley should be cut for grain when the joints of the stems begin to turn brown, but for hay it should be cut when the grain is in the dough stage. Barley is principally grown for grain, but it may be grown to a good advantage for either hay or silage, or may be planted with peas or vetch and hogged off.

VETCH, COMMON OR SPRING

By Byron Hunter.

The common vetch (*Vicia sativa*) is perfectly adapted to conditions west of the Cascade Mountains in Oregon and Washington and thrives on very poor soil. It has been grown in the Willamette Valley for many years, and is rapidly replacing red clover in many localities. It is an annual legume of great value as a nitrogen gatherer, as a green manure, and as a soiling, hay, and pasture plant. It is also a very valuable cover crop in orchards when sown in the early fall. It makes excellent ensilage, and dairy cattle prefer the hay to that of red clover. The yield of cured hay is from 1½ to 4 tons per acre. A seed crop yields from 15 to 30 bushels per acre, the yield depending quite largely upon the efficiency with which the seed is saved. A bushel of clean seed weighs a little more than 60 pounds.

Common vetch stands the winters admirably in Western Oregon and Western Washington, and is sown in the autumn from the last of August to the last of November. It is sown also in the early spring, but fall seeding usually gives the largest yields. The stems of this vetch are not strong, and heavy crops are inclined to flatten out on the ground. When in this fallen condition it soon begins to mold and is very difficult to harvest. To furnish support for it and keep it up off the ground a bushel of oats, wheat, or rye, and a bushel of vetch per acre are usually sown together. Oat hay, especially for dairy purposes, is usually preferred to that of wheat or rye, and for this reason oats are usually sown with vetch, winter oats being sown in the fall and spring oats in the spring. It is a common practice with vetch growers to sow winter oats and vetch broadcast in the early fall on land that has raised a spring crop to cover the seed with a disk harrow. If the land is loose and easily worked, this method gives good results, but like most other crops vetch gives much better yields if sown on a well prepared seed bed. If the ground is packed, or if the seeding is done in the spring, the land is usually plowed and a good seed bed prepared.

Sown with rye the last of August or early

in September, common vetch should be ready for soiling, i. e., feeding green, from April 15 to May 1; sown with winter oats or wheat October 1, it should be ready about May 1; sown with winter oats or wheat in the late fall, it should be ready about June 1; sown with oats in February, it should be ready about June 15. When cut in the early spring for soiling a second crop may be cut or pastured, or the land may be plowed and planted to some other crop.

Since fall-sown vetch matures for hay in June and rains are not infrequent at this season of the year it is quite a common practice to pasture it in the early spring—March and April—to keep the growth from becoming so heavy that it will fall before it is cut and to retard its development so that haymaking will occur after the rains are over. If the crop is heavy and falls during bad weather it is best to make ensilage of it immediately.

When the seeds are just appearing in the first pods is usually considered the best time to cut vetch for hay. Some cut it earlier than this, while others allow the first seeds to become pretty well mature. If the crop is not too heavy it may be handled in the ordinary way, but it should be put into cocks before the leaves are dry enough to be broken off during the handling.

VETCH, HAIRY OR WINTER

By Prof. A. F. Gaines.

Winter vetch (*Vicia villosa*) is a biennial, as the name suggests, and should be planted in the fall. It is usually seeded with winter wheat, rye or barley, thirty pounds per acre, drilled in with from thirty to sixty pounds of grain. The seed bed should be rather rough and preferably freshly plowed. The vetch seed should be inoculated just before planting with nitro-culture from some reliable firm or state institution to insure nodule formation on the roots, so essential for the upbuilding of the soil and the increase in protein of the crop growing with it.

A vetch and grain mixture makes excellent hay for stock. Winter vetch seeded in August or September makes one of the best cover-crops for orchards. Plowed under in the spring it adds greatly to the fertility of the soil. It is essential to eat it before it becomes over ripe, for seed production, as it shatters very easily. It may be harvested with the mower with the lifter-buncher attachment, and threshed with a threshing machine in much the same way that field peas are handled.

PEAS, FIELD

By Byron Hunter.

Field peas (*Pisum arvense*) are well adapted to the conditions of Western Oregon and Western Washington. They do well on a large variety of soils, but are especially adapted to clay soils and alluvial bottoms. They are grown for grain, hay, ensilage, and soiling. Peas are nutritious, and the hay and ensilage are eaten with relish by most kinds of stock. When grown for hay about 2 bushels of peas and 2 bushels of oats per acre are sown together as early in the spring as the condition of the ground will permit. When sown at the same time the oats often choke out the peas. This may be largely avoided by sowing the peas first, preferably with a drill, since the seed is difficult to cover, and when they have sprouts on them about 2 inches long drill in the oats. This will give the peas the start and they will hold their own much better. If sown broadcast they should be well covered with a disk harrow. Peas should be cut for hay when the seeds in the first pods are just ready for table use. Sown in the early spring they mature for hay from the 1st to the 15th of July. The yield is from 1½ to 4 tons per acre. When harvested for seed the yield is usually from

25 to 30 bushels per acre. Peas are often sown alone and harvested when mature by swine turned into the field.

The pea weevil often does considerable damage to the pea crop, especially when grown for seed. When sown late, peas suffer much more from the ravages of this pest than they do when sown early. Since they stand considerable frost they should be sown as early in the spring as the season will permit. Of late years peas fail in some localities from other causes than the weevil. They assume a pale, sickly appearance and yield and quality of the hay are very unsatisfactory. In localities where this happens common vetch and pearl vetch should be grown instead of peas, for they are sure crops and are equal or even superior to peas in practically every way as a forage plant.

MILLET

By Prof. E. F. Gaines.

Millet is used as a catch crop where some other crop has failed, as it is one of the quickest crops to mature. It requires hot weather to germinate, and produces a good crop when planted as late as June or July. It should be planted shallow, about one inch deep, on a rather firm seed bed.

Millet makes very rich hay if cut just as the last heads are out of the boot. For seed it should be cut rather green (the leaves and stems are still green after the seed is mature) and allowed to cure in the bundles, which should be shocked in bundles two and two.

FETERITA

By Prof. E. F. Gaines.

This interesting grain sorghum refuses to head out at Pullman, Wash., but produces a great number of leafy stems much like winter wheat planted in the spring. Down along the banks of the Snake River, at two thousand feet less elevation and an average of fifteen degrees higher temperature, it matures well and has been known to produce as much as forty bushels of seed per acre.

Feterita should be seeded about ten days later than corn, and given frequent shallow cultivation. It is more drought resistant than corn and has some promise where the climate is too dry for corn. It should be planted in rows three and one-half feet apart and the plants should be about eighteen inches apart in the row for seed or about six to ten inches apart if the crop is to be cut for fodder or silage.

KAFFIR CORN

By Prof. E. F. Gaines

Kaffir is one of the largest of the grain sorghums. It requires a longer, warmer season to mature than Feterita or Milo, but produces a greater yield under favorable conditions. It is important to have a well compacted seed bed with a three inch freshly worked mulch when the seed is planted. Frequent shallow cultivation until the time to lay it by should be given. It may be harvested and fed as fodder much like corn, or it may be headed and threshed with an ordinary threshing machine with part of the concaves removed to prevent cracking.

BROOM CORN

By Prof. E. F. Gaines.

Broom corn will mature a crop in a colder climate and on less rainfall than any of the other sorghums. The soil should be worked in early spring to conserve moisture, then again just before planting to destroy weeds. It is usually planted about ten to fifteen days later than corn. It should be planted rather thin to get a uniform salable product. One and one-half pounds of viable seed should be sufficient to plant an acre. The cultivation should be much the same as for corn; shallow, flat, frequent cultivation is best, as the large feeding roots lie near the surface.

SORGHUM

By Prof. E. F. Gaines.

The forage sorghums are still in the experimental stages in the Northwest. There is some indication that some of the earlier maturing varieties will become acclimated and prove of value in the drier, hotter valleys of this country. Seed bed preparation and cultivation is the same as for corn; i. e., a well compacted soil with a two to four inch mulch worked just before planting. If the soil is fall plowed it should be harrowed in early spring to kill weeds and conserve moisture, then again as the spring rains cause the surface to become crusted. Harrowing is preferred to cultivating until the sorghum is three to four inches high. This should be followed by frequent shallow cultivations. Sorghum hay or sorghum fodder is more difficult to cure than other hay, therefore more time must be given for curing.

BUCKWHEAT

By Prof. E. F. Gaines.

Buckwheat may be grown on rough, poorly prepared land, but will respond to better treatment with an increase in production. The land should be plowed early to allow time for the vegetation or manure which is plowed under to decay. Occasional harrowing before planting is advisable to conserve moisture. Seeding should be delayed until the soil is warm, as buckwheat is very sensitive to frost. June is the month to seed. Shallow seeding with a drill, four pecks (52 lbs.) per acre, gives the best results. The variety known as Japanese Buckwheat is harder than other varieties for the Northwest. The crop is usually harvested with a binder shortly after the first blooms have matured seed. It is well to cut in early morning or on cloudy days to prevent shattering. This crop is used principally for bee pasture, but the meal from the seeds makes excellent hot-cakes.

SOY BEANS

By Prof. E. F. Gaines.

Only the earliest varieties of soy beans are grown successfully in the Northwest, as they are very sensitive to frost and require a relatively hot season to mature, much like the sorghums. Soy beans do best when planted in rows and cultivated. Much the same method of culture is used for soy beans that is used for raising common beans. The stems are woody and of questionable value for roughage, but the seeds are rich in oil and are considered a very concentrated food. Soy bean oil is extracted from the seeds and is used as a substitute for linseed oil in the preparation of paints. Soy bean meal is the basis of many choice dishes served by the Chinese and Japanese.

FLAX

By Prof. E. F. Gaines.

Flax is easily injured by frost but is adapted to the cool northern part of the temperate zone. The seed deteriorates rapidly, and heats in the bin unless very well cured and thoroughly dry.

The land for flax should be plowed as long before seeding as possible to allow the seed bed to settle together. Just before seeding the ground should be harrowed so that a shallow mulch about an inch deep is obtained. The seed should be drilled one to two inches deep at the rate of two to four pecks (28 to 72 lbs.) per acre for seed, or four to eight pecks (56 to 112 lbs.) for fiber. It should be planted about the same times as corn or slightly later.

KALE, THOUSAND HEADED

By Prof. H. B. Scudder.

A deep, well drained rich loam soil is best for this crop hence the ordinary valley silt

loam soil, if well drained, thoroughly tilled, and heavily manured, will produce excellent yields. A long, narrow, slightly sloping field running alongside a piece of sod ground, or a wide sodded fence row, or one of the farm lanes, is preferable, as the hauling then may be done on the firmer ground during the wet winter weather. The kale should not be planted on the sod ground itself, however, as this often leads either to injury from cut-worms or from drying out of the soil where the sod is not thoroughly broken down.

The kale ground should be heavily manured and deeply plowed in the fall if possible, and replowed once in the early spring and again before trans-planting. If fall plowing cannot be done, manuring during winter and spring and deep early spring plowing and discing, repeated twice before transplanting, will put the ground in good shape. Following the second plowing and discing the ground should be kept clean of weeds and thoroughly mulched to conserve moisture by frequent light harrowing until transplanting time.

For transplanting the seed should be sown in drill rows about three feet apart, as early in March as it is possible to get on the ground. If possible a strip of the best drained ground on the farm should be used for growing the young plants, and this should be manured and plowed in the fall so that it need only be re-plowed and worked down at once for seeding in the early spring, thus getting the plants started as early as possible. On sandy loams the seeding need not be done so early, unless very early fall feed is desired. One pound of seed will furnish more than enough plants for an acre.

MARROW CABBAGE

By Prof. L. J. Chapin.

Marrow cabbage is a hybrid secured by crossing kohlrabi, thousand headed kale, and the Jersey chou. It resembles kale very closely when young, but as it grows older the stalk enlarges, reaching a diameter of from three to six inches at the largest part. The stalk varies in height from two to four feet, depending upon the richness of the soil, and often weighs ten or more pounds. It has a solid pith, or marrow, and it is from this that it takes its name. A peculiar natural habit of the marrow cabbage is that the lower leaves enlarge and then turn yellow and fall off. Then the next lower leaves enlarge and in due time turn yellow and fall, and so on until the stalk becomes bare for two-thirds or more of its length. These leaves may be pulled off and fed just before they begin to turn yellow. It is this habit that makes the marrow cabbage an especially suitable soiling plant for poultry during the summer and fall months.

RAPE, DWARF ESSEX

By Byron Hunter.

Rape (*Brassica napus*) has been grown in the Willamette Valley with excellent results for twenty years. It is a succulent, nutritious forage plant, admirably adapted to the moist, mild climate of the Pacific Coast. It stands considerable freezing, and is seldom winter-killed west of the Cascade Mountains. It does best on deep, warm, well-manured loamy soils. It succeeds well also on peaty soils, but is not adapted to very light sandy or heavy clay soils. It is a heavy feeder, and must not be expected to succeed on poor, worn-out land.

Rape is an excellent crop for pasture or soiling, i. e., for cutting and feeding green for hogs, sheep, goats, and poultry. Fed to dairy cows it causes a large flow of milk, but to avoid tainting the milk it should be fed immediately after milking, at the rate of 30 to 50 pounds per day, in two feeds. On account of danger of bloating, sheep, goats, and cattle should never be turned on rape for the first time when they are hungry, or when the rape



is wet with dew or rain. They should have plenty of something else to eat first, and plenty of salt at all times. It is a good plan to give them access to hay or a grass pasture to prevent overloading on rape. When sheep have become accustomed to it they may be left on it continually with but little danger.

Rape is grown and utilized west of the Cascade Mountains in several different ways:

(1) When grown for early summer use, the largest yields and the best results are secured by making a succession of plantings at intervals of two or three weeks, beginning in the early spring as soon as the ground can be put into perfect tith. The ground should be well manured and the seed planted in drills 24 to 36 inches apart at the rate of about 23 pounds per acre. A common garden drill may be used in planting small areas, but for larger fields a grain drill, with some of the feed hoppers closed to make the rows the desired distance apart, answers the purpose best. As soon as the plants are sufficiently large they should be cultivated often enough to control the weeds and keep the soil in good tith. The cultivation will retain the soil moisture and tend to keep the plants growing vigorously. Unless cultivated during the dry portion of summer, growth almost ceases until the fall rains come. Rape grown in this way may be used either for pasture or for soiling.

When rape is used for soiling purposes it should be cut at least 5 inches high, so that the plants will have a chance to grow again. In from six to eight weeks after planting it should be large enough to cut; by making a succession of plantings green, succulent feed should be on hand throughout the summer. If rape is used for pasture, the best results will be secured by having a number of small fields which are pastured alternately. It may be fed in this way also by means of movable fences. Rape should be from 12 to 14 inches high before it is used for pasture, and hogs should be prevented from rooting while in the field. When rape is removed by cutting or pasturing closely, the evaporation of soil moisture is rapid, and it should be cultivated as soon as possible if a second growth is desired. If sown in drills, stock will walk between the rows while feeding, and much less will be broken down and destroyed than if they were feeding upon rape that was sown broadcast. A larger yield is also secured by planting rape in rows and cultivating it.

(2) Another favorite way of growing rape is to sow it broadcast at intervals in the spring. The land is plowed and thoroughly worked in the early spring, as soon as it is in good working condition, and then allowed to lie until the seeding is done. Just before each piece is sown the ground is cultivated thoroughly again and from 3 to 4 pounds of seed sown and covered with a harrow or cultivator. Instead of sowing the seed broadcast it is sometimes planted with a common grain drill. Rape sown the 1st of May should be ready for pasture the 1st of July; if sown the 1st of June, it should be ready for pasture by the 1st of August. Grown in this way rape makes excellent pasture during the summer, fall, and early winter.

(3) Another method of raising rape that is popular with many farmers, especially those who raise sheep or goats, is to grow it with clover. The method of doing this has already been fully described in the discussion of red clover.

(4) Rape is sometimes sown with oats in the spring on a thoroughly prepared seed bed. The oats are used for either hay or grain. The rape grows but little until the early fall rains come, after which it is soon ready for pasture. From 2 to 4 pounds of rape seed per acre are sufficient when sown in this way.

(5) From 3 to 4 pounds of rape seed per

acre are also sown with corn just before the last cultivation. The seed is then covered by the cultivator and the rape comes on and makes good pasture as soon as the corn is harvested. It may also be sown with potatoes, but it does not succeed so well with them as with corn, for the digging of the potatoes destroys much of the rape. Sown after early potatoes are dug, it gives good pasture during the late fall and early winter.

ROOT CROPS

By Byron Hunter.

Since the soil requirements and the methods of culture of mangel-wurzels (*Beta vulgaris* var. *macrorrhiza*), carrots (*Daucus carota*), and ruta-bagas (*Brassica campestris*) are very similar, they will be treated collectively. Like rape and thousand-headed kale, they succeed best where the weather is moist and cool. Hence their eminent adaptation to Western Oregon and Washington. In this region the yield of these crops is enormous, the ordinary yield being from 20 to 35 tons per acre, while reports of 45 to 50 tons are not infrequent.

Root crops usually succeed best on deep, moist, friable loam soils. On clay land they grow too slowly, and the soil is also difficult to work. Ordinarily land for roots is heavily manured in the fall and then plowed considerably deeper than for other crops.

Soon after the seed is planted cultivation should begin. Harrow thoroughly every week or ten days until the plants are well above the ground. After this the surface soil should be cultivated often enough to hold an earth mulch and keep the weeds from starting. Cultivating deep close to the plants after they are half grown is apt to break off many lateral roots and this should be avoided. Sometimes the cultivator teeth may be adjusted to work deep midway between the rows and shallow near the plants. The soil may thus be stirred close to the rows without cutting off lateral and surface roots. Hill or ridge cultivation tends to destroy many of these roots, and unless the soil is wet or the tubers apt to grow out of the soil and sunburn, hilling should not be practiced. The crop is more readily harvested by this method and it is an easy habit to acquire, but in general it is not the best practice.

Late blight is a disease so prevalent in Western Washington that spraying to control it is almost a necessity. Bordeaux mixture should be used in such spray. Usually two applications of Bordeaux will be needed and during a rainy season more may be necessary. Make the first application when the plants are eight to twelve inches in height and watch the plants carefully to see when later applications are needed. As long as the spray shows plainly on the foliage of the plants it will not be necessary to make a second application, but it should be made as soon as the spray washes off. Drench the plants thoroughly on the upper and under sides of the foliage. The expense of spraying will vary with the cost of materials, ease with which they may be mixed and applied, and the strength and amount of the materials used. Copper sulphate, the active agent in Bordeaux mixture, is several times its normal price at present. It now costs from \$20 to \$25 an acre to make the same sprayings which cost from \$7.50 to \$10 an acre two or three years ago. During the past season conditions were not favorable for the development of blight in many localities, so that the loss was not generally severe, but in some seasons it is not uncommon to have a forty to sixty per cent loss in fields which are not sprayed.

Bordeaux mixture may be bought on the market in a paste form, but a more efficient mixture may be made by preparing the material just before using. Common formulas for this material are 4-4-50 or 5-5-50 when the

trees or plants are in foliage, and 6-6-50 when the trees are dormant. The 4-4-50 formula means four pounds of copper sulphate (blue-stone), four pounds of stone lime (quick lime), to every fifty gallons of water. The copper sulphate may be diluted by placing the number of pounds desired in a burlap sack and suspending it in a barrel on the surface of twenty-five gallons of water. In this way no stirring is necessary and the material will dilute over night, but if the crystals are thrown loosely in the bottom of the barrel it may take considerable stirring to dissolve them. Four pounds of quicklime is slacked in a little water and then diluted in enough water to make twenty-five gallons. The diluted copper and lime water are then poured or dipped from their respective barrels into the sprayer, at the same time, to give a good mixture. After the mixture has been made it should be used at once, but the copper sulphate solution or lime water may be kept separately for a long time if covered to prevent evaporation.

It is often convenient to make stock solutions of the copper and lime in quantities for future dilution by using a gallon of water for every pound of the material. When dilutions are needed for Bordeaux mixture a gallon of stock solution may be used for every pound of each material desired in the dilution. The copper sulphate and the Bordeaux mixture should be handled in wooden vessels, but this is not necessary for lime. Barrels or large wooden tanks are convenient vessels for handling the materials. If much Bordeaux is to be used it is more convenient to have the barrels or mixing tanks on an elevated platform so that the solution may be carried through hose or troughs to the mixing tank or sprayer by gravity instead of by hand labor.

To prevent clogging of the spray nozzles the mixture may be passed through a fine strainer on its way to the spray tank. An eighteen or twenty mesh brass wire screen makes a good strainer.

All metal parts of the spray machinery or equipment which comes in contact with Bordeaux mixture should be lined with brass to prevent corroding.

Shortly before digging time go through the field and mark with stakes the most vigorous plants. Dig those hills first and save the most desirable tubers from the best yielding hills. Use such tubers for the selected seed for next year.

If the grower has a large acreage of potatoes he can plant the selected seed in rows near the main field, giving it as good care as he gives the main crop. From these rows he may choose the best hills each year for the selected seed of next year, using the remaining rows for seed of the main field.

Good tubers for seed should be of the variety type and shape, should be free from disease and insects, free from knobs or irregular growths, and should have shallow eyes.

Potatoes for seed are best kept in bins, crates or trays in a cool, dry, well ventilated cellar or storage room where they can be frequently examined during the winter and the tubers removed which develop storage roots. Seed stored in pits or covered piles out-of-doors is not so accessible during the winter.

The market usually calls for about three usable grades, large, medium and small potatoes. The grower may make the grades and receive full value for his product or he may sell his potatoes field run and expect the buyer to discount enough from the market price to pay for grading, sorting, sacking, and shrinkage from small and diseased tubers.

He who makes potato growing a business, produces his own seed, and gives his crop good care, can usually expect a reasonable profit for his labor, but he who waits until

just before planting time to buy his seed, pays no attention to the details of planting, and neglects his crop during the summer, cannot expect a profitable crop.

LATE SOWN FEED CROPS

By Prof. E. B. Stookey.

Where an early maturing crop has been harvested, or where the soil cannot be put into shape until late in the summer, it is often desirable to put in some crop that will mature sufficiently for hay, or at least can be fed green or pastured. The crops that can be used will be determined largely by the amount of moisture in the soil, and the time necessary for the crop to develop sufficiently for use. The amount of moisture depends on the kind of soil and its treatment, and the kind of crop, if any, that has been harvested. The light sandy soils will have less moisture naturally than the heavier ones. It is often a question whether to risk putting in a crop or let the ground lay fallow. Each field is a separate problem, and the farmer will have to determine for himself whether there is enough moisture to grow a profitable crop. It must be remembered that during the latter part of July and August there is usually very little rainfall over Western Washington generally, and the moisture to grow the crop must be in the soil at the time it is sown. If the soil would grow a good crop of weeds it will probably produce enough crop to make it worth while planting it, but if the soil is too dry it will be a waste of seed to sow at this time.

Given a reasonable amount of moisture there are a number of crops that can be used with profit. If the crop is to be cured it will be necessary in most places to have it harvested by the last of September. If sown by the middle of July to the first of August that will give sixty to seventy-five days for the crop to grow. For soiling or pasture it would be possible to leave the crop on the ground thirty to forty-five days longer. As the crops sown at this time are used for different purposes they will be discussed separately.

Barley. On fairly fertile soil barley is one of our best crops for late sowing. It is commonly ready to cut for hay within seventy-five days when sown in early spring, and sown later maturity is hastened, but of course it does not make as rank a growth. Beardless barley is more desirable for hay than the bearded as the beards often make the animals' mouths sore. Success Beardless is somewhat earlier than the other varieties tried at this station. One and one-half to two bushels (72 to 96 lbs.) an acre is the usual rate of seeding.

Peas. Sown in the early spring, peas require eighty-five to one hundred days to mature sufficiently for hay, but seeded in the early summer will be ready for hay in seventy to seventy-five days. The White Canadian is the pea generally used, and is perhaps the only variety on the general market. Several varieties on trial at this station seem to give greater promise than the Canadian. Two to two and one-half bushels (120 to 150 lbs.) an acre is the usual rate of seeding. In some sections late sown peas are badly damaged by aphids (the small green plant lice). The dry, hot weather prevailing at this time is favorable to their development.

Oats. Oats require a little longer growing period than barley, so for the later summer seeding is not quite so desirable. The growth, however, is somewhat greater and the stem is stiffer, so are preferred to barley for growing with peas. When sown the first part of July, oats will probably produce more than barley. On bottom land sown the first of August last year oats made two and a half to three feet of growth, but did not head, while the barley was heading in sixty-five days from date of

sowing. This of course was sown too late for hay. The White Triumph and Canadian varieties of oats are somewhat earlier than the varieties usually grown in this section. Two to three bushels (64 to 96 lbs.) an acre is the usual rate of seeding. Mixtures of peas and barley or peas and oats are sometimes more desirable than any one of the crops alone.

Millet. Millet has a lower feeding value and requires as long or longer to mature than the above crops. The yield is less, too, so it does not seem advisable to use it as a summer catch crop.

Rape. Rape is a very quick growing crop, often being ready to pasture within forty to forty-five days from date of sowing, and in fifty-five to sixty-five days is ready to cut for green feed. Dwarf Essex Rape sown on bottom land the first of August of last year was two feet high sixty days from planting. On rich soil with enough moisture, rape can be sown quite late and still give very good results. It may be sown in rows and cultivated or may be sown broadcast. When sown in rows, one to one and a half pounds are required to sow an acre; when sown broadcast four or five pounds an acre are generally used. It is an excellent forage crop and deserves to be generally used.

Turnips. Of the root crops, turnips are the best adapted for late sowing. They make a rapid growth, and will have made good growth in sixty to seventy days after sowing. This will allow of their being sown in July and August provided there is a sufficient amount of moisture. Turnips may be sown broadcast or in cultivated rows, requiring about the same amount of seed an acre as rape. One advantage of sowing turnips late is that very little damage is caused by the root maggot.

It is very important that crops sown late in the season be given the most favorable conditions. The soil should be put in the best tilth possible and special attention should be given to retention of moisture. In order that there shall be enough moisture the soil must be cultivated immediately after the previous crop is harvested so that little moisture will be lost. After the crop is sown it may be advisable to compact the soil around the seed with a roller so that germination will be hastened. Peas may be harrowed just as they are coming up, and barley and oats may be harrowed after they are well up, if the harrow teeth are slanted back.

THE SILO

By Byron Hunter.

That the silo should have a very general use in Western Oregon and Western Washington, not only for the preservation of corn but for many other crops as well, ought to be apparent from an understanding of the climatic conditions of the region. As previously stated, most of the hay crops are ready to cut during the month of June, while spring rains frequently continue until about the 1st of July. (See table giving the distribution of rainfall on page 8.) It will thus be seen that hay-making ordinarily occurs at a time when good weather cannot always be relied upon. If meadows are pastured during the spring to retard the development of the crop, so that hay-making will occur after the late spring rains are over, the yield of the second crop is usually much lighter, since its growth is confined entirely to the dry season. By the use of the silo, on the other hand, the first crop may be cut for ensilage early in June, even though the weather be unfavorable for haymaking. If cut at this time, while the plants are still growing vigorously, a good second crop will usually mature for hay early in August—the best having season of the year. A light third crop can be used for pasture or cut for ensilage late

in the fall. It is evident, therefore, that the use of the silo will practically insure the saving of the first crop, increase the total yield per acre, and cause the second crop to mature at a time when good haying weather can usually be relied upon.

That all kinds of ensilage should be finely cut may be desirable, but we must not get the idea that it is essential. For years ensilage of the finest quality has been made in Western Oregon and Western Washington out of whole clover and grass (timothy, English rye-grass, etc.). In making ensilage of this kind, however, there are two essentials—an air-tight silo and great care in filling it.

Farmers who use the silo as indicated above agree that the first crop of grass and clover should be cut for ensilage from the 1st to the 15th of June, for the earlier the first crop is cut the greater will be the yield of the second.

Difficulty is usually experienced in raking up freshly cut green grass with an ordinary hay-rake. Some farmers avoid this difficulty by cutting with a self-raking reaper or a mower with a buncher attachment. These bunches are then thrown on a wagon by hand. Others cut with an ordinary mower and load from the swath with a hay loader. The heavy green grass often bends the teeth on the elevator bars of the loader. The teeth may be reinforced by nailing blocks of wood on the elevator bars just back of the teeth.

In filling the silo the material must be evenly spread and thoroughly tramped, so that all of the air possible will be excluded. If this is not done, much of the ensilage will spoil. Two principal methods were found in use by farmers in filling silos. In the first the freshly cut grass is dropped directly into the silo with a hayfork. Two men in the silo spread the material and tramp it thoroughly, especially around the edges. The center of the silo where the loads from the fork fall requires but little tramping. The second method is to drop the material upon a platform at the top of the silo by means of hay slings or a hayfork. A man upon the platform throws the material into the silo, placing it as best he can. Another man spreads it evenly in the silo and tramps it thoroughly. This is perhaps the safest method, for there is less chance to slight the work. For a few days after the silo has been filled, the settling of the material will allow the addition of two or three loads each day, each load being thoroughly tramped when added. When the filling is completed the top is covered about 1 foot deep with marsh grass or other waste material that will pack closely and exclude the air. This is wetted thoroughly and tramped daily for several days, using about 2 barrels of water at each wetting. The writer has seen ensilage of excellent quality made from whole grass in this way. He has also seen ensilage made by dropping the material into the silo without spreading and tramping that was practically a total loss.

SOILING (GREEN FEEDING) CROPS

By Byron Hunter.

The mild western climate and abundant rainfall of Western Oregon and Washington make it almost an ideal region for the production of soiling crops. By the judicious selection of planting of crops green succulent food may be provided for the dairy cow during practically the entire year. That a much greater amount of feed can be obtained from the same area of land by this system as compared with pasturing is a fact well recognized by the progressive dairymen. Much of the tillable land of this region is now very valuable. As values advance beyond the limit where farm land may profitably be used for pasture and it becomes necessary for the small farmer to keep the maximum number of stock upon his few acres of tillable land, the growing of soiling crops becomes of vital importance.

Below is given a list of crops that are used for this purpose. The dates of planting and the approximate dates upon which these crops may be used are also given. It must be under-

stood, however, that the variation in seasons prevents one from saying definitely when a crop will be ready to use.

Dates for Planting and Using Soiling Crops in Western Oregon and Western Washington.

CROPS	WHEN PLANTED	WHEN USED
Rye and vetch	September 1 to 15.....	April 1 to May 15.
Winter oats and vetch	September and October.....	May 15 to July 1.
Winter wheat and vetch	Do	Do.
Red clover .....	.....	Do.
Alfalfa .....	.....	During June.
Oats and peas	February	Do.
Oats and vetch	Do	June 15 to July 15.
Oats and peas	April	During July.
Rape	May 1	Do.
Oats and peas	May	During August.
Rape	June	Do.
Corn	May 10 to 20.....	During August, September and October.
Turnips	July 1	Late fall and early winter.
Thousand-headed kale	March 15 and transplant- ed June 1.....	October 15 to April 1.
Mangel-wurzels, carrots and rutabagas.....	April	October 15 to April 1 (fed from bins, pits or root houses).

Plants that produce their seed in two-valved pods, such as peas, beans, vetch and alfalfa, are called legumes. The value of this family of plants as soil renovators has long been recognized, but in just what way they are capable of restoring fertility to the soil has not been understood until recent years. If the roots of a leguminous plant be carefully removed from the soil little lumps, called nodules or tubercules, will usually be found upon them. These nodules vary in size with different legumes and may be found alone or in clusters. On the roots of red clover they are about twice as large as the seed of that plant. The nodules are caused by bacteria that are parasitic in the roots.

By the aid of the bacteria living in the nodules, leguminous plants are enabled to assimilate atmospheric nitrogen. Since nitrogen constitutes approximately four-fifths of the atmosphere this family of plants has an inexhaustible supply of this important plant-food element. Other plants cannot assimilate the nitrogen of the atmosphere; they can obtain it only from decaying organic matter and from commercial fertilizers containing nitrogen. Chemical analyses show the tissues of leguminous plants to be very rich in nitrogen; hence the value of these plants when plowed under as green manure. The roots of a clover crop ordinarily contain more nitrogen than the whole crop removes from the soil. As these roots decay, the plant food in them becomes available for other plants. Nitrogen is usually the first element of plant food that needs renewing; hence the great value of leguminous plants as soil renovators.

Generally speaking, the nodules of each kind of legume are caused by certain kinds of bacteria. Thus there is one kind of alfalfa, another for red clover, another for common vetch, and so on. At any rate the nodule-forming bacteria of red clover, for example, have become so accustomed to that plant that they are of little or no value in forming nodules on the roots of most other legumes. If nodule-forming bacteria are not in the soil no nodules will be formed; the failure of leguminous crops is often due to this cause. These bacteria may be artificially supplied in two ways, namely, by means of pure cultures of the bacteria and by transferring soil from one field to another. For further information regarding these two methods, see Farmers' Bulletin No. 240, U. S. Department of Agriculture.

Most soils in the state of Washington are as yet fairly new. Their native or virgin fertility is not yet exhausted. There are, however, many different types of soils in the state, some of which do not naturally contain very large supplies of the different elements of plant food needed by crops.

Such soils are likely soon to "run out," and need application of fertilizers carrying the particular elements in which they are deficient. Other soils which carry fairly good supplies of the different elements of plant food have been improperly handled or wastefully cropped until badly out of condition. These can best be restored or built up in fertility by the use of fertilizers to stimulate increased growth until the soils can be properly brought back into good condition.

Fertilizers may, therefore, be used for two separate purposes, namely, the application of some one or more single elements of fertility to correct deficiencies in those particular elements, or the application of a complete mixed fertilizer to stimulate crop growth.

The only possible means of determining whether fertilizers for either of these purposes can be profitably used is by field experiments. A chemical analysis of the soil indicates the total amounts of plant food which are present but does not show how much of this is available for use of different crops, nor does it prove whether the use of any given fertilizer would yield enough increase in crop growth to pay for the cost of the fertilizer. Field trials with fertilizers are, therefore, the only conclusive evidence of their value.

But chemical analysis do indicate which elements are likely to be deficient because of an insufficient total supply. The Washington State Experiment Station has completed a soil survey in the course of which samples of every type of soil found in the state have been analyzed. The following brief statement of the conclusions to be drawn from these analyses will serve as a basis for field experiments with fertilizers on the different types of soil as mentioned.

Reclaimed tide flats are usually well supplied with all the essential elements of fertility but are likely to be "sour" because of excess of organic acids resulting from the decay of large amounts of organic matter. They, therefore, generally need lime as a fertilizer to correct this acidity.

The red-fir uplands or second bench lands usually contain fairly good supplies of mineral

plant foods but limited amounts of humus, and need the plowing under of some clover crop or the addition of a complete fertilizer.

Alder bottom lands are rich in decaying vegetable matter but usually low in phosphorus and lime.

The potash content of all soils west of the Cascade Mountains is usually low, and for those crops like fruit and vegetables, which need large proportions of potash, fertilizers carrying potash are generally very beneficial.

Phosphorus is usually present in sufficient quantities in upland soils, but likely to be deficient in the lower lands.

Nitrogen is present in abundance in the bottom land soils, but often deficient in upper gravelly or clayey soils, particularly if they have grown large forests of fir and pine.

Special types of soil such as shot clay, beaver dam, gravel prairie, etc., require special treatment.

Marshy bottom lands, whatever the type, are almost invariably sour, because of the excess of decaying organic matter and lack of lime.

Shot clays are usually strong soils, ordinarily carrying a good supply of phosphorus and nitrogen, but are apt to be somewhat deficient in potash. The percentage of lime is rarely very high, but seems in most cases to be sufficient for plant needs. The plowing under of vetches or clovers gives specially good results on this type of soil.

The sage brush soils of the irrigated valleys east of the Cascade Mountains are very rich in lime, carry fair supplies of potash and phosphorus and are very low in nitrogen and humus. The addition of nitrogen carrying fertilizers or plowing under of leguminous crops is the first necessity, while for special fruit crops potash fertilizers are generally profitable.

Most of the upland soils of eastern Washington are very rich in all the mineral elements of fertility. The supply of humus and nitrogen is only moderate, and in regions of low rainfall is quite low. The proper attention to the humus supply will probably be all that will be necessary for long continued fertility, particularly for extensive cropping. For intensive cropping, such as market gardening, fruit growing, etc., the addition of humus forming fertilizers will give profitable results.

Soil fertility means essentially favorable conditions for crop growth. This naturally depends upon many different things. For example, a soil might be abundantly supplied with all the necessary elements of plant food in proper form, yet if the soil were to remain dry throughout the season, no crops would grow in it. Again, a soil might contain abundant available fertility and plenty of moisture but remain frozen through an entire season, in which case no crop would grow. In a broad sense, therefore, fertility requires favorable conditions of moisture supply, temperature, state of tillage, sufficient supply of plant food of proper kind, etc. As commonly used, however, the term fertility means a sufficient supply of plant food in available form.

What is available plant food? A little thought will show that it is plant food in such form that it will dissolve in soil, water or plant root juices. Plants have no power or ability to absorb food in solid form. Plant food is taken from the soil through the roots and circulates in the sap. It must, therefore, be in liquid form, and available plant food is that form of plant food which can be dissolved from the soil and so be taken up in liquid form. The availability of plant food is, therefore, measured by its solubility in plant juices.

All the chemical elements in the soil (of which there are about fifteen) may be taken up by the plants, but not all of them are of equal

use or value. Some are not necessary at all to plant growth. Others which are necessary for plant growth are always present in the soil in abundance. A few which are absolutely necessary for all plant growth are commonly present in the soil in comparatively small proportions. These are the so-called "critical elements" of fertility; namely, nitrogen, phosphorus, potash and lime.

The element nitrogen is used by plants in building up the green growing foliage. Phosphorus is essential for the production of seeds. Potash aids in the building up of starches or sugars, which are essential parts of all plants. Lime is in some obscure way connected with the building of woody fiber.

Obviously then, all these elements are necessary for every kind of farm crop, although different amounts are needed by different crops.

Lime, in addition to its value as a direct plant food, has much to do with the physical condition of the soil and the availability of plant food. Fertility, from the standpoint of plant food, therefore, requires a sufficient supply of each of these four critical elements in proper or available form.

Lime, potash and phosphorus are all found in rocks. They are the mineral elements of fertility.

Nitrogen is not a mineral element, and is not found in rocks. Nitrogen comes originally from the air, but must be converted into liquid or available form by the decay of plant tissue containing it. It can be taken from the air only by the bacteria which grow on the roots of leguminous clover plants, including alfalfa, clovers, vetches, peas, beans, etc. These bacteria take nitrogen from the air, and when they die and decay make the nitrogen which they contain available for other plants.

Most soils contain considerable supplies of all the essential elements of fertility, generally enough to last for a hundred years or more. The problem of fertility is that of getting this plant food into available form.

The chief agencies for dissolving mineral plant food materials are the bacteria and acids which are developed in decaying vegetable and animal matter. Rotting vegetation, or humus, is therefore the best agency for maintaining or increasing the availability of plant food.

This accounts for the well known beneficial effect of manure. The actual benefit of manure when applied to soils is at least double the value of the plant food which the manure supplies, because of the fact that the manure in rotting dissolves and makes available plant food which was already present in the soil in unavailable form.

One of the best means of increasing fertility of soils is, therefore, the plowing under of some humus forming material. For this purpose barnyard manure is best. Next in value are so-called "green manures" or green crops plowed under. Of these the legumes are by far the best because they are the nitrogen gathering crops.

A red clover crop when plowed under adds to the soil about \$20.00 worth of nitrogen which the bacteria associated with it have taken from the air.

Other green crops, like rye, buckwheat, etc., when plowed under, produce humus, and, therefore, help to make available the plant food already present in the soil, but they do not add to the soil any of the critical elements of fertility which were not already present in the soil.

In the absence of a sufficient supply of barnyard manure, commercial fertilizers may profitably be used; particularly if the price of land, or market conditions make it undesirable to lose the use of the land while green legum-

inuous crops are being grown to be plowed under.

Again, the addition of available fertility in the form of commercial fertilizers often profitably supplements the supply of available fer-

LIME FOR CORRECTING ACIDITY IN THE SOIL

By Prof. E. B. Stookey

Based on chemical analyses, it may safely be said that most soils in Western Washington are in need of lime. The analyses of the U. S. Reconnaissance soil surveys of Western Washington shows a deficiency of from 0 to 30,000 pounds of limestone per acre, with the large number of samples showing a need of less than 2,000 pounds per acre.

This means that this much limestone is required to neutralize the acid in the soil. It is generally conceded that the greatest need of lime in the soil is to counteract acidity. Lime, however, is essential to plant growth, has a beneficial effect on the physical conditions of soils, and aids in liberating plant food.

Where lime is needed the character of the plant growth is usually such as to indicate it. Sorrel and horse-tail rush are generally present, and replaces red clover. Red clover shows the need of lime in the soil as quickly as any other plant. The litmus paper test is fairly satisfactory. Blue litmus paper, pressed against moist soil, will turn red or pink if the soil is in need of lime. The length of time it requires to change color indicates in a general way the amount of lime required. If the action is slow, probably one thousand pounds of lime, or one ton of ground lime rock, per acre, would be sufficient. A light soil will require less lime than a heavy one.

The kind of lime to apply will depend on the soil condition and the result to be accomplished. This will be better understood if we know what the different forms of lime are, and the effect of each.

Lime, or calcium oxide, is known as quick-lime, burned lime, stone lime, lump lime, unslacked lime, etc. Calcium oxide is composed of forty parts calcium and sixteen parts oxygen by weight. In all lime fertilizer compounds, calcium is the element that should be considered.

We may consider the weight of calcium oxide as 56. When quick-lime is slacked it combines with water and forms hydrated lime, known chemically as calcium hydroxide. If we slake 56 pounds of pure lime there is produced 74 pounds of hydrated lime. The weight is increased almost half, and the bulk is more than doubled by this chemical addition of water. If just a sufficient amount of water is used, the lime will fall apart into a fine white powder.

If this 74 pounds of slaked or hydrated lime is exposed to the air for a few days it will completely air slake, the water taken up chemically will be replaced by carbonic acid gas from the air, and there is produced 100 pounds of air slaked lime, known chemically as calcium carbonate.

Ground limestone rock is made from calcium carbonate rock, and is chemically the same as air slaked lime. Air slaked lime is usually in a finer state of division than ground limestone, and will contain some quick-lime and some hydrated lime.

If 100 pounds of pure limestone rock is kiln burned it will form 56 pounds of quick-lime. We see then that 56 pounds of quick-lime equals 76 pounds of hydrated lime or 100 pounds of air slaked lime or ground lime rock.

Some recent experiments carried on by the Pennsylvania State College show that ground lime rock is as effective for the correction of soil acidity as an equivalent amount of quick-lime.

Quick-lime is caustic in its effect; that is, it

burns substances that it comes in contact with if moisture is present. If water is added to lime it generates heat, and expands. Barreled lime often breaks the barrels, because of the absorption of moisture and exposure to air. If quick-lime is put on the soil it does not remain long in lump form. As soon as water falls on lime it slakes and forms hydrated lime, and the hydrated form soon changes to the air slaked or carbonate form.

The chief determining factor in the use of commercial fertilizer is, of course, the profit which may be obtained from their use.

Theoretically the humus in the soil is burned by the lime undergoing these changes, and practically we find that the humus content of the soil organisms diminishes under such treatment. This decrease is probably due in part to the increased activity of the soil organisms working on the humus.

Ground lime rock or fully air slaked lime applied to the soil does not have a caustic action, and is not so chemically active, so the action of soil organisms is not so greatly accelerated. It does, however, correct soil acidity. Ground limestone and fully air slacked lime are therefore the safest forms of lime to apply.

On soils that are rich in humus, such as the peat and muck soils, the loss of humus will not be serious, and on such soils quick-lime or hydrated lime may be used. Many soils in Western Washington, in fact most upland soils, are deficient in humus, so that it would seem unwise to put anything on them that would burn out the small supply.

Lime will not take the place of manure or commercial fertilizers, nor will manure or commercial fertilizers take the place of lime.

If quick-lime is to be used it may be applied in several different ways. The lump lime may be placed in small piles over the field, and slaked with a pail of water, or the lime piles may simply be covered with earth. In this way the lime will slake by drawing moisture.

After the lime is slaked the piles of lime are scattered evenly over the ground. When applied in this way the application is usually made in the fall or during the winter. Lime in this form is caustic, so must be applied a considerable length of time before a crop is to be put on the land. After the lime is spread, it should be well incorporated with the soil by discing or harrowing.

The quick-lime is sometimes slaked and then applied. Considerable care is necessary to use just enough water so the lime crumbles into a fine state of division. It should not be allowed to burn, nor should too much water be used, as that makes it hard to handle. In this form it should be applied during the winter or very early spring. This form is caustic, and would injure a crop planted too soon after the lime is applied.

Finely divided quick-lime is sometimes spread directly on the land. Applications of this kind should be made in the fall or winter. It should be borne in mind that all forms of quick-lime are caustic. It is doubtful if this form should be used on a light soil. On a heavy clay soil, or a soil rich in humus, it may be profitably used, or if a soil is very strongly acid and it is desired to correct the acidity immediately this form of lime is desirable. After the acidity is once corrected it is perhaps advisable to use a safer form of lime, and in a smaller amount.

Hydrated lime can be secured commercially and is in a finely divided state. Quick-lime that is no longer fresh enough for building

purposes is sometimes sold for hydrated lime. If airslaked lime is used, there will probably be some quick-lime in it. The quick-lime should be slaked before using.

Quick-lime is easily converted into hydrated lime by slaking with water. It will sometimes be cheaper to buy quick-lime and slake at home, than to buy lime in any other form. Any form of hydrated lime is caustic, therefore it should be applied in the late fall to early spring, as a crop would be injured by it. It should be disced or harrowed to thoroughly incorporate it with the soil.

Ground lime rock, fully air slaked lime, ground shells, and such carbonaceous materials, can be obtained commercially, and at a reasonable figure. These forms of lime can safely be applied at any time as they are not caustic and will not injure a growing crop or sprouting seeds.

Any of these forms, to give the best results, should be in a very fine state of division. Although it requires more of these than of the other forms of lime to be as effective, yet they can be used without danger of burning a crop or the humus in the soil. It may well be said that they embody the good qualities of the other forms of lime, but will not injure the soil or a crop. If more than necessary is used, there need be no fear of injury.

Experiments at the Illinois Experiment Station seem to indicate that two tons per acre of ground limestone usually give the highest returns. Subsequent applications of a ton per acre should be used whenever the soil begins to show signs of acidity. It is considered good practice to apply one or two tons of carbonate of lime per acre every five or six years.

Any of the caustic forms of lime should not be applied with manure. The carbonate forms of lime, however, could safely be applied with manure, but it is seldom done. Manure should be plowed under, but any form of lime should be applied to the surface and thoroughly incorporated with the soil by discing or harrowing.

Lime can be applied broadcast but is more easily applied with a fertilizer attachment or a fertilizer drill.

It should be remembered that the highest returns cannot be secured unless the fertility and humus supply of the soil is maintained.

Different crops are effected differently by liming. While some crops are benefitted, some do not give any reaction one way or the other, and some are injured if there is too much lime present. The last are known as acid loving. The following classification of plants is taken from the report of work done by the Rhode Island Experiment Station, and Bulletin No. 6 of the U. S. Department of Agriculture.

Plants usually benefitted by lime applications are alfalfa, asparagus, beans, beets, barley blue grass, cantaloupe, cherry, cabbage, clovers, cucumbers, cowpea, dandelion, egg plant, gooseberry, lettuce, onions, oats, parsnip, pepper, pea, peanut, plum, pumpkin, red raspberry, rhubarb, spinach, squash, tobacco, timothy and wheat.

Plants indifferent to lime are apple, corn, cotton, carrot, millet, peach, pear, red top, Rhode Island bent grass and rye.

Plants impaired by large amounts of lime in the soil are blue grass, blackberry, black raspberry, potato, radish, seradella and watermelon.

Plants adapted to acid conditions are blueberry, buckwheat, carrot, corn, cranberry, hairy vetch, millet, oats, potato, raspberry, red top, rye, strawberry and turnip. While these plants are adapted to acid conditions, some of them will be benefitted by liming. It will be noticed that some of the plants in the list are included in one of the other classifications.

Brief Points on Liming

1. The different forms of lime contain different amounts of calcium.

2. To improve a poor, acid soil, plow under manure, apply lime and disc in, and grow legume crops in the rotation as much as possible.

3. Lime corrects acidity, but rarely acts as a true fertilizer.

4. Use burnt lime with caution.

5. Ground limestone and thoroughly air slaked lime are not injurious to soils or crops.

6. Lime is not a "cure-all" for every soil ailment.

NITRATE OF SODA FOR GARDEN CROPS U. S. Department of Agriculture Bulletin No. 162

The result of experiments by the New Jersey stations to test the value of several common forms of nitrogenous fertilizers for certain market garden crops have been summarized in an earlier number of this series. In a recent bulletin of the stations Prof. E. B. Voorhees gives the results of further experiments along the same line. The purpose of the later experiments was to study the value of different amounts of nitrate of soda for several prominent market garden crops, and also the effect of applying the nitrate in two and three equal dressings, the first when the crops were planted, and others when the character of the season and the growth of the crops indicated.

The question of the proper use of nitrate of soda is of special importance because (1) it is an expensive fertilizer, (2) it furnishes only one element of plant food, namely, nitrogen, and (3) it furnishes nitrogen in a form which is highly soluble, and consequently is not only quickly absorbed by the plant roots but is also readily washed out of the soil and lost. In order, therefore, that this fertilizer may be most economically and profitably employed it is necessary not only to use it in proper amounts but to apply it in such a way that the nitrogen is used by the plant to the fullest possible extent.

If the quantity found to be necessary for a definite increase of crop, under average conditions, were applied at once, say in the early spring, a greater opportunity would be offered for losses from leaching than would be the case if the material were given in successive dressings, so that the losses due to the escape of the nitrogen would be minimized; on the other hand, if no losses occurred, the plant might take up more than could be utilized in a normal development, thus defeating the purpose, because resulting in a produce of less commercial value. This would apply, of course, only in the case of those crops that are injured by abnormal development in certain directions, as, for example, too large a proportion of straw in cereal grains, too large root in sugar beets, etc. All these may be obviated by a fractional application, or, in other words, by supplying the nitrogen at the time and for the purpose in view in its growth. The results from the use of nitrogen may also be unsatisfactory if nitrogen only of the essential elements is used. The best results from the use of nitrate can come only when there exists in the soil, or are applied with it, sufficient amounts of the mineral elements to enable the plant to obtain a food suited to its needs.

The experiments of the New Jersey stations were planned to determine not only the best amounts of nitrate to use in case of various garden crops, but also the best method of application. The land used in the experiments was very fertile, but in order to insure an abundance of phosphoric acid and potash in the soil it was further enriched in every instance by applications of 350 pounds per acre

of a fertilizer containing 3.69 per cent of nitrogen, 7.85 per cent of available phosphoric acid, and 6.39 per cent of potash. The results obtained with the different crops were briefly as follows:

Cabbage—With this crop there was a yield of but 910 prime heads per acre when no nitrate of soda was used. When 300 pounds of the nitrate was applied per acre in two equal dressings the number of prime heads obtained was 3,260. When the same amount was applied in three equal dressings the yield of prime heads per acre was 5,390. On the plot which had received 400 pounds of nitrate of soda per acre in two equal dressings the yield was 4,160 prime heads per acre, and when this same amount was applied in three equal dressings 7,580 prime heads were obtained per acre. From these figures it will be seen that the use of the nitrate of soda greatly increased the yield of prime heads in every instance. It will further be noticed that when the nitrate was applied in three equal dressings proved more effective in increasing the largest yields were obtained. Applying the nitrate in three dressings proved more effective in increasing the yield than increasing the amount 100 pounds. For example, 300 pounds in three equal dressings was more effective than 400 pounds in two equal dressings, and the best yield of all was obtained by applying 400 pounds in two equal dressings, and the best yield of all was obtained by applying 400 pounds of nitrate in three equal dressings. Not only was the yield much greater than on any other plot but the quality of the cabbage was much improved, the heads selling for 50 per cent more than those from any other plot.

Celery—As with the cabbage crop noted above, 300 and 400 pounds per acre of nitrate of soda were used on different plots in two and three equal dressings. The average increased yields of all the plots, due to the use of nitrate, was 17,810 pounds or 132 per cent. This was on good land previously well fertilized with 450 pounds of high grade fertilizer. No marketable celery whatever was obtained when the nitrate was not used, and the use of the ground, expense of growing, etc., was a total loss. Where the nitrate was used the crop was worth on the average \$378.10 per acre. The cost of the nitrate was but \$1. This is equivalent to a gain of \$54.01 for every \$1 invested in the nitrate of soda. As to the influence of the amount applied the average increased gain due to the use of 400 pounds of nitrate was 255 marketable roots, worth \$25.19. When the nitrate was applied in three equal dressings there was an increased gain on the average of 495 plants, worth \$31.10 over the yield obtained when the application was made in two equal dressings. The gain from the third application was considerably larger when the 400 pounds of nitrate was applied than when 300 pounds was used, the value of the increased gain in the former case being \$16 and in the latter \$56.38. These results indicate the value of a liberal quantity of nitrate of soda for celery as well as judicious distribution throughout the season.

Tomatoes—With tomatoes the heaviest yields were obtained when 200 pounds of nitrate of soda was used per acre in three equal dressings. The increase in the yield in this case was 5,880 pounds. When the same amount of nitrate was used in two equal dressings the gain was but 3,220 pounds. When 300 pounds of nitrate of soda was used in two equal dressings the increased yield was 4,610 pounds. When the same amount was applied in three equal dressings the increased yield was but 3,540 pounds. The third application in this case caused a larger growth of vine and later maturing fruit, thus considerably reducing the yields.

Turnips—This crop is often grown for early market. In the station experiments different plots were fertilized with nitrate of soda at the rate of 200 and 300 pounds per acre, respectively, in two and three equal dressings. Where no nitrate was used the yield was 8,230 pounds per acre; when 200 pounds was applied in two equal dressings the yield was increased to 12,740 pounds; and when in three equal dressings the yield was but 11,220 pounds. When 300 pounds was applied in two equal dressings the yield was 16,520 pounds, and when in three equal dressings the yield was but 13,360 pounds. These figures show that while there was a greatly increased yield in every instance due to the use of the nitrate of soda, the best yields were obtained when the nitrate was applied in two equal dressings rather than three. The late dressings seemed to induce growth of tops rather than of roots. The greatest increase in yield and the most profitable crop was obtained from the use of 300 pounds of nitrate of soda in two equal dressings.

HOW AND WHEN TO APPLY COMMERCIAL FERTILIZERS

The best method and time for applying commercial fertilizers depends upon conditions and the kind of fertilizers used. They should be gotten into the ground in time to become dissolved and available when the young plants are ready to use the plant food.

Some of the slow acting fertilizers are best applied a considerable time before the seed is sown, and on heavy soils not liable to be washed by winter rains those fertilizers may be applied during the winter or fall prior to sowing the seed.

On light sandy or gravelly soils, from which some of the fertilizers might be washed by rains, it is best to apply them at the time of seeding, or a few days before.

The complete mixed fertilizers are usually best applied at the time of seeding or a short time before, but will often give excellent results if used as a top dressing after the plants are up. These fertilizers are composed of a variety of fertilizing ingredients, some of which are almost immediately available and others are slower acting and release the plant food only as fast as it is required by the plants.

Most of the nitrogen fertilizers are readily soluble, and should not be applied until the seed is sown, or used as a top dressing later. Nitrate of soda and nitrate of lime have produced best results when applied in several light applications at intervals of two or three weeks during the early growing season.

Commercial fertilizers may be sown broadcast evenly all over the field, and harrowed in before the seed is sown; they may be drilled in with a special fertilizer drill, either at the time the seed is sown or later; they may be scattered in the hills or drills where the seed is to be sown provided they are scattered evenly and thoroughly mixed with the soil; or they may be used as a top dressing after the seed is sown or after the plants are up, in which case rain and cultivation will work them into the soil. Any method that will distribute them evenly in the soil where the roots of the plants will reach them will be effective. In small operations they are sometimes applied by dissolving in water.

In any case they should be applied evenly and thoroughly mixed with the soil, so that no considerable quantity will come into direct contact with the seeds or roots.

When used for fruit trees, berry bushes, etc., they must, of course be used as a top dressing, and may be sown broadcast or a small quantity may be distributed around each plant or tree, and cultivated into the soil.

WEEDS -- HOW TO CONTROL THEM

(From Farmer Bulletin 660)

IMPORTANCE OF WEED CONTROL

In a sense, farming might be called a warfare against weeds. Some farmers emerge from the struggle victorious, while others go down to defeat. So powerful are weed enemies in reducing crop yields, while at the same time multiplying labor, that the farmer should at every turn strengthen his position against them. He should bear these invaders in mind in planning the crops he will grow and in deciding on the fields where he will grow these crops, in choosing the implements he will use, in buying his seed, and in many other activities. Lack of careful planning with reference to weeds is apparent in nearly every community. Here a man planted more corn than he could properly care for. There a man has left his field in meadow too many years. Here a man did not thoroughly prepare his field for alfalfa. There a man has seeded clover that was full of weed seeds. And for just such causes weeds not only make serious inroads on the current crop yields, but at the same time thoroughly infest the land and fortify themselves against future attacks.

The importance of keeping weeds in subjection can not be emphasized too strongly. It has been shown in experiments with corn made by the United States Department of Agriculture that weed eradication is the principal, if not the only, beneficial result of cultivating this crop after planting. This means that in cultivating the corn crop the implements used should be designed primarily for accomplishing the destruction of weeds in the easiest and cheapest way. It seems to indicate further, that as weed control becomes more thorough, intercultural tillage of growing crops may be accordingly decreased.

Some men do not attack weeds with enough vigor; they look for rocking-chair methods of work. There is no royal road to weed control. In the main, the old doctrine of "hard work and plenty of it" must be observed, but unless this work is applied intelligently a vast amount of labor may be expended and but little accomplished beyond than a temporary abatement of the evil.

It may be seen, therefore, that thought as well as work is a requisite in the control of weeds. It is with the idea of directing thought to this important subject that this bulletin has been prepared.

There are three main principles of weed control. It is believed that an understanding of these principles and the method by which they may be put into practice, as given in the following pages, will greatly lessen the amount of work required to subdue weeds.

What Is a Weed?

A weed has been defined as a plant out of place. This definition is not entirely satisfactory, for two reasons: (1) Because a plant may be out of place and still not be a weed in the popular sense, as rye growing in a wheat field, or Kentucky bluegrass in an alfalfa field; and (2) because a plant may not be out of place and still be a weed in popular language, as is described in a subsequent section of this bulletin on the good points about weeds. In reality a weed is a wild plant that has the habit of intruding where not wanted.

Weeds, even under adverse conditions, are able to maintain their existence. Some weeds produce immense quantities of seeds; some mature seeds in a very short time; some have seeds which are difficult to separate from crop seeds; some possess roots or rootstocks that live for a number of years. Weeds persist,

therefore, because they are well equipped by nature in one or more ways to hold their own in the struggle for existence.

Good Points About Weeds

Weeds are not always useless. Sometimes they are the principal means by which organic matter is restored to the soil, and, generally speaking, a soil is productive in proportion to the quantity of organic matter it contains. In many parts of this country it is customary to farm land until the crops are too poor to be profitable and then "turn it out to rest." This merely means that weeds are permitted to grow on it for several years; after that the soil will be more productive.

Weeds are also useful at times in preventing soil erosion, especially during the winter months. Weeds are further useful in collecting and holding the nitrates and other soluble salts during periods when crops are not being grown, thus preventing these valuable nutrients from being washed out of the soil. Ordinarily, however, all these benefits may be realized through proper rotations, in which case it is a serious mistake to let weeds grow.

DAMAGE DUE TO WEEDS.

The full reason why weeds reduce yields is not definitely known. It is well recognized that weeds deprive crops of moisture, plant food and sunlight, and by these means cause decreased yields. Experiments have shown, however, that even where there is a supply of moisture and plant food sufficient for the needs of both the weeds and the crop, weeds still exert a detrimental effect. This may be due in part to the weed roots giving off substances which are poisonous to crops. A more generally accepted explanation, however, is that the roots of the weeds interfere with the root development of the cultivated plants. This is thought by many to be the principal factor involved, and undoubtedly it plays an important part. The fact that weeds do harm in more ways than has been supposed is all the more reason why the farmer should make strenuous efforts to subdue these invaders. Land that should produce 60 bushels of corn may yield no more than 20 bushels if weeds are not kept down by adequate cultivation, and the net profit to the farmer is relatively much less for the resulting poor crop than these figures on yield show.

Another loss results from the presence of weed seeds in crop seeds. This necessitates much labor in separating or results in dockage by dealers if the separation is not made. Wheat containing wild-onion bulblets is sometimes docked as much as 5 per cent, and in some cases there is no sale at all for such wheat. The agricultural experiment station of Minnesota estimates that in that State alone the damage to wheat due to weed seeds amounts to two and a half million dollars yearly.

There are other causes of damage resulting from weeds, which in some cases are important. The harvesting and curing of crops are sometimes made difficult by the presence of weeds. Russian thistle, bindweed, and Canada thistle usually are a source of great annoyance at harvest time to the growers of small grains. Again, some weeds harbor fungi and insects which attack near-by crops; the clubroot of cabbage is fostered on the wild-mustard tribe of weeds, and the Colorado potato beetle lives also on nightshade and henbane. Furthermore, some weeds are poisonous or otherwise injurious to man, livestock, or livestock products. Poison ivy, sumac, jim-

son weed, and the seeds of corn cockle are poisonous to man; wild onion and bitter-weed spoil dairy products; cowbane, water parsnip, and loco weed are poisonous to stock; and the barbed seeds of squirreltail grass and porcupine grass penetrate the noses and mouths of livestock, causing painful sores.

It is difficult to estimate the damage of weeds, but it is probable that they cost the American farmer several hundred million dollars every year.

CLASSIFICATION OF WEEDS ACCORDING TO LENGTH OF LIFE.

In fighting weeds it is extremely important to know how long they naturally live and their habits of reproduction. Weeds are divided into three classes according to their duration or length of life: (1) Annuals, (2) biennials, (3) perennials.

Annual weeds live only one year, maturing their seeds and then dying. Ragweed, smartweed, and crab-grass are examples of annual weeds. Some annuals germinate in the fall, live through the winter, and mature their seeds in the spring. These are called winter annuals. Examples of winter annuals are shepherd's-purse, peppergrass, and fleabane.

Biennial weeds live two years. During the first year they grow rather slowly, producing usually a taproot and a rosette of leaves close to the ground, but the second year they send up flower stems that produce seed and then die. Examples of biennial weeds are blue-weed, bull thistle, and wild carrot.

Perennial weeds produce each year underground parts which live over to the next year and produce top growth. These underground parts may be of various kinds. They may consist of long, more or less horizontal roots, as in the case of the bull nettle, milkweed, and Canada thistle, or the underground parts may consist of rootstocks or underground stems, as in the case of quack-grass, Johnson grass, and perennial sow thistle. Again, the underground parts may consist of bulbs that split up, as in the case of wild onion, or they may be more or less in the form of a taproot, as with dandelion.

THE CONTROL OF WEEDS.

Far more important than to kill weeds is to avoid having weeds to kill. In other words, the farmer should aim to prevent rather than cure the evil. A farm can be made almost free of weeds by strictly observing the following principles: (1) Prevent weeds from going to seed on the farm; (2) prevent weed seeds being brought to the farm; and (3) in the case of perennial weeds, prevent them from making top growth and thus finally starve out the underground parts.

The application of the three preventives outlined here is fully discussed in the following pages.

HOW TO CONTROL ANNUAL AND BIENNIAL WEEDS.

The annuals and biennials propagate themselves by seeds alone. In dealing with them it is necessary to observe only the first two of the above principles.

HOW TO CONTROL PERENNIAL WEEDS.

Most perennials propagate themselves by their underground parts as well as by their seeds; hence even if prevented from going to seed they still keep on growing. In dealing with them, therefore, it is necessary to observe all three of the above principles.

PREVENTING WEEDS FROM GOING TO SEED ON THE FARM.

Most persons do not realize what an enormous number of seeds are produced by weeds. The number varies with different species, most kinds producing from one hundred to several

thousand seeds per plant. Some weeds, such as wild carrot, burdock, and sow thistle are capable of producing 20,000 or more seeds to the plant. Moreover not all weed seeds germinate at once, but delay sprouting for a period, some of them for several years. This is the basis of the old saying, "One year's seeding makes seven years' weeding."

If it is not practicable for the farmer to dispose of his weeds when they are small he should make every effort to prevent them from going to seed. If weeds are attacked when the most advanced have just reached the full blossom stage, they can be prevented from seeding. At this stage, too, the roots are at their weakest, especially those of the annuals and biennials which are largely exhausted. No time should be lost however, in disposing of weeds when the full-blossoming stage has been reached, as seeds will shortly be formed. Some weeds, such as pigweed, produce blossoms that are very inconspicuous, so that unless closely watched they will go to seed before one is aware of it.

Tillage to Control Weeds.—While tillage in its relation to weeds usually is practiced for the benefit of the immediate crop, it also may serve the purpose of preventing hosts of weeds from maturing seeds. Thorough tillage serves the additional purpose of encouraging the rapid germination of weed seeds in the soil while killing the weed seedlings when young. In no way is the old adage "A stitch in time saves nine" better illustrated than in killing weeds by tillage soon after they have germinated rather than delaying the work until they have attained some size.

The thorough preparation of the seed bed for every crop is an important part in the control of weeds. After plowing, nearly all farmers use a disk or a spring-tooth or spike-tooth harrow to reduce the soil to a good seed-bed condition. Each of these harrowings destroys hosts of young weed seedlings. As it is only the weed seeds within a few inches of the surface of the soil that germinate and as the harrowings encourage the rapid germination of the weed seeds, thorough harrowing at this period may be relied upon to kill a large portion of the weeds that will appear during the season. In fact, it sometimes happens that the seed bed has been so well prepared that after planting a cultivated crop, such as corn, cotton, or potatoes, but little cultivation is required.

After planting the cultivated crop the same object, that of attacking the weeds when young, should be kept in mind. To this end a drag harrow or a spike-tooth harrow is frequently used, both before and after the crop comes up. More weeds will be killed by one dragging at this time than by several cultivations when the plants have become larger. The weeder is also a valuable implement for use at this stage. By removing some of the teeth of this tool it can be used in corn until the crop is nearly waist high, indeed, some excellent crops of corn have been grown by the use of the weeder only. Some soils are too stony or otherwise not suited to the use of this implement, but where it can be used the weeder is one of the most valuable tools on the farm. The drag harrow and weeder may also be used to advantage with potatoes, cotton, and other cultivated crops. After the crops have become so large that these implements can no longer be used, the tillage is performed with cultivators. Cultivators that destroy weeds most effectively should be used. The best tools for this purpose vary with the kind of crop and the type and condition of the soil, so that it is difficult to lay down exact rules as to the choice of cultivators. Inter-cultural tillage is especially effective in controlling weeds if the crop has been planted

in checkrows, so as to permit the implement to work in two directions.

If the work of preparation and aftertillage has been thorough, few weeds will come up and go to seed after cultivation stops. This is especially true where a winter cover crop, such as wheat, crimson clover, or vetch follows the opportunity to rid a farm of weeds. If prop-

Cultivated crops, therefore, offer abundant erly handled, they are rightly termed "cleaning crops." On the other hand, where these crops are not well cultivated, weeds are actually stimulated to vigorous growth and prolific seeding. Such crops are consequently a boon or a menace, depending upon how they are handled.

Besides the usual cultivated crops, small-grain crops can also sometimes be cultivated to advantage in the spring with a spike-tooth harrow or weeder. This does not permanently injure the young crop, and it kills hosts of small weed seedlings which would otherwise make trouble. Farmers in the upper Columbia River basin are able to control wild mustard by repeatedly harrowing fall-sown wheat in the spring; without this harrowing the mustard would be very troublesome.

After the small-grain crop is harvested it is often good practice in the Northern States to harrow or disk the stubble to encourage the germination of the weed seeds that are at or near the soil surface. The seedlings are killed by the fall plowing or by cold weather. Some weeds, such as ragweed and foxtail start to mature seeds soon after harvest, so that care must be taken to turn the plants under before the seeds approach maturity. Plowing without the preliminary disking would turn under millions of weed seeds to make trouble in future years.

Mowing to Prevent Seeding.—Mowing is another way of preventing weeds from going to seed. As a rule, it is best to mow when weeds have reached the full-blossom stage. Many farmers mow their pastures once or twice each year and as a result have gradually driven out the weeds and thickened the grass stand. When there are patches in grain fields thick with weeds, it will pay to cut them, grain and all, before the weeds start to go to seed. Most careful farmers mow or cut their fence-row and roadside weeds once or twice a year to prevent their seeding.

It pays to cut a hay crop early, in order to prevent weeds from going to seed as well as to secure a better quality of hay. After a grain crop is removed, a crop of weeds, such as rag weed or foxtail, usually follows, which, if not disturbed not only reseeds the land for further crops of weeds but may do much damage to a young seeding of clover or grass. Mowing these weeds will prevent most of them from going to seed, and, further, the clippings will be of value as a mulch for the young grass.

Hand Work to Prevent Seeding.—Quite often a few scattered weeds will occur in a field. These weeds can be removed by hand with little work, whereas if allowed to mature they would thoroughly seed the land and make trouble for the future. Such weeds may be prevented from seeding either by hand pulling or by digging them out with a mattock, hoe, or spud so far below the surface that new top growth will not spring up and mature seeds. Annual and biennial weeds will make no further appearance if pulled or cut off when they are in full blossom. Many farmers have cleaned their farms of corn cockle, wild mustard, and many other weeds by a few hours of hand work each year when these weeds were in full blossom.

Spraying to Prevent Seeding.—In case of certain weeds infecting small-grain crops it has been found profitable to spray with a solution

of copper sulphate, iron sulphate, or salt. If this treatment does not entirely kill the weeds, it at least prevents them from going to seed. Such treatment if well done, does not permanently injure the grain and is effective against the weeds. This method seems to be of most use against the wild mustard family of plants.

The spray solutions are made by dissolving either 12 pounds of copper sulphate, 100 pounds of iron sulphate, or 125 pounds of common salt in 50 gallons of water. This quantity of solution is sufficient to spray about one acre. Any machine that throws a fine mistlike spray may be used. Where acres of considerable size are to be treated, a traction sprayer with a boom 12 to 20 feet long is the most economical equipment. In the case of wild mustard in small-grain fields the best time to spray is when the most advanced of the mustard plants are just starting to bud.

Sheep Pasturing to Prevent Seeding.—Sheep are of use in preventing weeds from seeding. A pasture on which sheep are running is usually more nearly free of weeds than where cattle or horses are pasturing. In some parts of the United States sheep are turned into standing corn after cultivation stops, for the purpose of pasturing off the late weeds. Sheep turned on grain stubble tramp weed seeds into the soil, thus causing many of the seeds to germinate at once. The resulting plants are either pastured off or frozen out.

Burning to Prevent Seeding.—Burning weeds is often useful in killing weed seeds, both in connection with weeds cut green and allowed to dry and with matured weeds. It is sometimes necessary to gather such plants into piles before they will burn, but it is always best to disturb them as little as possible, so that the seeds will not scatter.

PREVENTING WEED SEEDS FROM BEING BROUGHT TO THE FARM.

The second of the three main points in weed control is preventing the introduction of weed seeds on the farm. No matter how careful a man may be in preventing weeds from going to seed on his land, most of his work will be for nothing if he permits seeds to be constantly brought to his farm from the outside. Another important point regarding weed control is to destroy pernicious weeds before they have gained sufficient headway to do serious damage. Farmers should ever be on the alert for the appearance of new weeds which are being introduced and for old weeds which are developing noxious tendencies. When a plant shows any tendency toward becoming a troublesome weed, it should be called to the attention of someone in authority and every effort made to keep it under control.

Weeds may be brought to the farm in various ways. The principal source of introduction is through seeds.

Introducing Weed Seeds in Crop Seeds.—Many of the purchased grain, clover, and grass seeds contain weed seeds as impurities. How can the farmer purchase clean seed? In no permanent way will the quality of seed offered for sale be greatly improved except by greater knowledge and alertness on the part of the consumer. First the farmer should know what constitutes good seed; second, he should know fairly closely what high-grade seed is worth; and third, he should be willing to pay a fair price for it. Laxity on one or more of these points is responsible for most of the farmer's troubles over poor seeds. Seedsmen say that they are forced to carry poor seeds in stock because many farmers will not pay for the better grades. Cheap seeds are really the most expensive kind that can be purchased.

In improving his knowledge of what constitutes good seeds, the farmer will find the advice of the State agricultural experiment sta-

tions and the United States Department of Agriculture of great assistance. These institutions gladly test samples of seeds for farmers free of charge. The test will show whether there are any weed seeds or other impurities present and the percentage of germination of the crop seed. Many farmers are now making their own tests and with a little practice any man can learn to do this according to the directions issued by the Department of Agriculture. In either case it is necessary to get the test under way well in advance of the time of seeding. In purchasing seed of alfalfa and clover the most important point to consider is the presence of dodder seed. Clover seed should also be examined for seeds of the platanus.

Introducing Weed Seeds in Stock Feeds.—Some kinds of stock feed are free of weed seeds, while others are not. Cottonseed meal, oil meal, brewers' and distillers' grains, corn bran, middlings, and the gluten feeds are practically free of weed seeds; but molasses feeds, oat chop, wheat bran, and the mixed feeds are apt to contain more or less seeds of various weeds. This is especially true of that class of mixed feeds made from mill by-products for the reason that such by-products are partly composed of screenings. These screenings contain weed seeds resulting from the cleaning of grain. Some firms grind or heat the screenings that go into mixed feeds, and in such cases the percentage of live weed seeds is very low. A number of States require that the ingredients in stock feed be named in the labels on the bags and this is desirable in all States. Some States also issue feed-control bulletins, stating the analysis of various feeds offered for sale, including the proportion of viable weed seeds. If the farmer reads these bulletins and the labels on the bags he will be in a position to judge whether or not he is introducing weed seeds on his farm in stock feeds.

Introducing Weed Seeds in Manure.—Nearly all purchased manure is full of weed seeds. If it is hauled to the farm when fresh, many thousands of weed seeds are introduced, so that the farmer is storing up future trouble for himself. As this manure usually has to be removed from the town in the fresh state, the only chance to compost it in order to make the weed seeds rot is after it reaches the farm. It has been found that the weed seeds in manure piles rot quickly under ordinary conditions, so that practically all of them have lost their vitality in two months. Whether the farmer should compost city manure by leaving it in piles after he has drawn it to his farm is questionable. This would require extra handling, and unless care is exercised the manure will lose some of its value. Still, in many cases it would undoubtedly pay to do this for the sake of keeping the farm free of weeds. The answer to this question depends largely upon the farmer's cropping system.

Introducing Weed Seeds With Thrashing Outfits.—Thrashing outfits are very likely to bring weed seeds to the farm. It is a wise precaution to see that the separator is well cleaned before it reaches the farm, or at least is cleaned in a place where the weed seeds will not be scattered on the fields. Wild mustard is very apt to be introduced by this means. A very progressive farmer in Vermont, who has driven this weed entirely from his place, goes out with a broom to meet the thrashing machine just before it reaches his farm and attends to cleaning it himself.

Introducing Weed Seeds in Hay and Straw.—Purchased hay and straw are almost sure to contain weed seeds, and as long as a man continues to buy them there is little chance for him to have a weed-free farm. The only way to prevent seeds getting to the land where

hay or straw is purchased is to leave the resulting manure in a pile, or, better yet, in a pit, for several months before spreading.

Introduction of Weed Seeds by the Wind.—Lastly weed seeds may get to a farm by being wind blown. This is especially true of chicory, dandelion broom sedge. Canada thistle, and such other weeds as possess a light, feathery pappus. Such seeds may be carried a mile or more in a strong wind. The Russian thistle of the Western States is perhaps the greatest wind-blown weed pest. The matured plant, which is almost round in shape rolls across the prairie, scattering seed as it goes. A good fence is very effective in arresting the progress of this enemy.

The individual farmer is almost helpless against the introduction of most weed seeds by means of the wind, and the situation requires community action. Most of our States have weed laws which were enacted to prevent certain weeds from going to seed, but these laws are not rigidly enforced. Some day a more enlightened public opinion will require the enforcement of the weed statutes. The individual farmer, however, can greatly lessen the evil effects of wind-blown weeds by keeping a continual lookout on the boundaries of his farm, especially on the side of the prevailing winds, and by destroying the weeds as they appear.

PREVENTING THE TOP GROWTH OF PERENNIALS.

The last of the three weed preventives is keeping down the top growth of perennials, in order to starve out the underground parts. This top growth is equivalent to the lungs of animals; without it they cannot live. Any methods that successfully keep down the top growth and at the same time suit the farmer's convenience may be used. Among the ways that may be adopted for keeping down top growth are the following: (1) Clean cultivation; (2) pasturing; (3) growing smother crops; (4) frequent cutting with a hand hoe, spud, or mower; and (5) smothering small patches with building paper or other material.

Clean Cultivation.—In most cases cultivation will have to be relied upon to destroy perennials. The work may be done either with or without a cultivated crop growing on the land. Many farmers have eradicated perennial weeds by giving thorough cultivation to a crop. Cultivation is especially effective if the crop has been planted in checkrows, so as to permit working in two directions. The ordinary shovel and tooth cultivators permit many weed stems to slip through unharmed. It is often best, therefore to use cultivators of the sweep or weed-knife type. These sweeps skim along under the surface of the soil and cut off all weed stems. On many of the modern cultivators, sweeps 9 to 18 inches wide may be attached in place of the shovels.

No matter how thoroughly the tops have been kept down during the period of cultivation, most well-established perennials will continue to send up tops after cultivation stops. This situation may be met by frequent chop-pings with a hoe. Hand hoeing in such cases is not as tedious as it may seem, since most perennials do not occupy the land solidly, but occur in patches. If the top growth is thus thoroughly kept down one year is usually sufficient to eradicate even the worst of our perennials. This plan is especially effective against Canada thistle, bull nettle, and bindweed, or wild morning-glory.

Perennials may often be attacked most effectively by clean cultivation without growing a cultivated crop; in other words by a bare fallow. It is seldom advisable to fallow for an entire year, since this does not permit the farmer to get any use of his land. A better plan is to use the land during the early part of the season and to fallow it the latter part.

For instance, the land may be pastured until midsummer, or a crop of hay or small grain may be taken off before starting the fallow. This plan has the additional advantage of starting the work of eradication by fallowing at a period when nearly all weeds are in their most susceptible stage. Under this plan the work of fallowing should be started as soon after harvest as possible; the land should be plowed and then harrowed or disked at frequent intervals during the remainder of the season to prevent top growth. Ordinarily, shallow plowing is best in fallowing for weed control, as this keeps the mass of weed roots at or near the surface, where they will be more easily dried out by the sun. If this fallowing be well done, many kinds of perennials will have died by the close of the season but it is usually advisable to plant a cultivated crop the next spring in order to destroy such weeds as may persist. Under this plan the greater part of the work of eradication is done expeditiously by large implements and without the hindrance of cultivated crops; furthermore, it is done at a time of year when the farmer is ordinarily not pressed with other work. This method is quite successful against the weedy grasses, such as Johnson grass, Bermuda grass, and quack-grass.

Pasturing.—Pasturing may often be found of much help in keeping down the top growth of perennials. Sheep are of first importance in this connection. They will browse upon almost all kinds of weedy growths and fatten under the process. In parts of the West when the pasture grasses become brown during the summer, sheep will turn their attention to the weeds, which are the only green feed in sight. This fact has been taken advantage of in killing bindweed and the small-leaved milkweed. Goats are even more omnivorous than sheep, but the regions where it is profitable to keep goats are limited. Hogs are of some value in weed eradication, because they will root for the underground parts of many weeds. These animals have been used to great advantage in getting rid of bindweed, or wild morning-glory.

Where it is feasible to confine sheep, goats, or hogs to very restricted areas for one or more seasons they will in most cases completely kill perennial weeds. Where it is not practicable to graze sufficiently close to entirely destroy perennials the grazing still greatly weakens the root system of these plants, making it an easy task to complete the destruction by cultivation.

Smother Crops.—Thick stands and vigorous growth of smother crops may be depended on to keep down the top growth of perennials. The most commonly used smother crops are alfalfa, buckwheat, soy beans, millet, sorghum, and bar clover. Some weeds are more susceptible to this treatment than others. Bermuda grass may be eradicated by a continuous succession of smother crops. Alfalfa, where it succeeds well, is the most effective smother crop, largely because it combines frequent clipping with the smothering effect. It may be relied upon to reduce greatly or even to eradicate entirely most perennials except some of the grassy weeds. In the case of smother crops, as with pasturing, the principal value is to weaken the root systems of perennials, which facilitates the work of cultivation which is to follow.

Mowing or Cutting.—Cutting off repeatedly the tops of perennial weeds which a mower, scythe, or other tool may sometimes be used to advantage. This is of most use on pastures, roadsides, and other uncultivated places. It has been found that mowing twice a year for two years will eradicate the fern brake, one of the bad weeds of pastures in New England and New York.

Smothering With Building Paper and Other Materials.—Where perennial weeds occupy

very limited areas it is often practicable to prevent further spread by covering the infested area with building paper, taking care to lap over and weight down the ends so as to exclude all sunlight. Manure, straw, and other materials are also employed for this purpose.

CONCLUSION.

The problem of suppressing weeds is a many-sided one and an important part of the management of the farm. Successful crop management includes successful weed management.

Larger Crops Mean Fewer Weeds.—Generally speaking, the larger the crops, the fewer the weeds present. This is especially true with small grain and hay, since good stands of these crops will tend to smother out weeds. Furthermore, pastures that are given good care by top-dressings and by not over-grazing always contain fewer weeds and more grass than those poorly managed.

Special Methods of Handling Certain Weeds.—The farmer should know the kind of weeds which he has to fight, because in the case of some of them special methods have been discovered which greatly reduce the amount of work necessary. The United States Department of Agriculture has issued bulletins treating individually a number of the worst weeds and these publications may be obtained on request.

Rotations and Weeds.—An important benefit from practicing a rotation is in the control of weeds. If land is planted to the same crop year after year, certain weeds have ample opportunity to make top growth and mature their seeds, and these weeds therefore become firmly established; but if the land is planted to different crops in succession these weeds do not have the opportunity to make nearly as much headway.

Furthermore, adopting a rotation usually means the growth of grass, clover, or other forage crops. These crops not only discourage many kinds of weeds by their shading effect, but also give weeds a poor chance to mature seeds, as they are cut for hay before most weeds ripen.

Again, adopting a rotation often means growing cultivated crops on land where such crops have not been raised. The value of cultivated crops in cleaning land of weeds has already been emphasized.

Demonstrations of the value of a rotation in controlling weeds are available in many localities. For example, in western Kansas wheat is usually grown continuously, and when this is the case weeds are very troublesome; but when a rotation, including a cultivated crop and a forage crop is adopted, the weeds that are so common under continuous wheat growing do not have so much chance to make growth and to mature their seeds. Hence, weeds become very much reduced. Another example is furnished in parts of eastern New York, where it is customary to keep land in meadow for many years. These meadows become foul with orange hawkweed, oxeye daisy, wild carrot, and other weeds. Introducing a cultivated crop and a grain crop soon disposes of most of these weeds.

Cooperation in Controlling Weeds.—Probably no feature of weed control is more important than cooperation among those concerned. Weed control is a community problem rather than one for the individual farmer to solve, and without the cooperation of his neighbors the results of the individual farmer's efforts are more or less discouraging, because where weeds are allowed to grow undisturbed they produce sufficient seeds to infest the adjacent lands. The necessary cooperation might be arranged through agricultural clubs and other farm organizations.

FIFTY WORST WEEDS

Table 1 gives an alphabetical list of the 50 worst weeds of the United States, with such information as will enable the reader (1) to identify them. (2) to determine the nature and place of their greatest injuriousness, and (3) to determine their duration or natural length of life; that is, whether annual, biennial, or perennial. With this knowledge one will be able to attack much more intelligently any troublesome weed.

TABLE 1.—Descriptive list of the fifty worst weeds of the United States.

Common name, botanical name, and duration of life.	Color, size, and arrangement of flowers.	Sections where injurious.	Method of seed distribution; vegetative propagation of the perennials.	Place of growth and products injured.
Bindweed, field bindweed, (<i>Convolvulus arvensis</i>), P.	White or pink; 1 inch; solitary.	Entire United States, especially California.	Grain and flax seeds; creeping roots.	Rich moist soils; grain and hoed crops.
Buffalo bur, sand bur (<i>Solanum rostratum</i>), A.	Yellow; ½ inch; solitary.	Illinois and Colorado to Texas.	Plants rolled by wind; seeds in hay and by animals.	Fields; grain and hoed crops, wool.
Bull nettle, horse nettle (<i>Solanum carolinense</i>), P.	Purple; 1 inch solitary.	Entire United States.	Plants rolled by wind; running roots.	Everywhere; grain and hoed crops, pastures.
Bur-grass, sand bur (<i>Cenchrus carolinianus</i>), A.	Green; ½ inch; bur.	Maine to Florida and westward to Colorado.	Animals, especially sheep.	Sandy land pastures and waste places; pastures and wool.
Chess, cheat (<i>Bromus secalinus</i>), A.	Green; spikelets in panicles.	All grain sections.	Grain seed; especially wheat.	Everywhere; grain fields.
Chickweed, common chickweed (<i>Alsine media</i>), A.	White; ⅜ inch; cymes.	Entire United States.	Grass and clover seed, animals; has a long seeding period.	Meadows, lawns; winter crops.
Cocklebur, clotbur (<i>Xanthium americanum</i>), A.	Green; ¼ inch head.	.....do.....	Carried by animals.	Cultivated fields and waste places; hoed crops and wool.
Crab-grass (<i>Syntherisma sanguinale</i>), A.	Green; spikes.....	Entire United States, especially the South.	Clover and grass seed, hay, animals.	Cultivated fields, gardens, lawns; hoed crops.
Daisy, oxeyedaisy (<i>Chrysanthemum leucanthemum</i>), P.	White with yellow center; 1 inch; heads.	Maine to Virginia and Kentucky.	Clover seed, hay; woody rather short rootstocks, but largely by seed.	Pastures, meadows, roadsides; hay, pasturage.
Dandelion (<i>Taraxacum officinale</i>), P.	Yellow 1 ¼ inch; head.	Entire United States.	Wind; taproot, which spreads but little.	Lawns, meadows, waste places; hay and lawns.
Dock, yellow dock, sour dock (<i>Rumex crispus</i>), P.	Green; ¼ inch; panicle.	.....do.....	Hay and straw, clover and grass seed; taproot, which spreads but little.	Hay, small grain and hoed crops.
Dodder, alfalfa dodder, field dodder (<i>Cuscuta arvensis</i>), A.	Yellow; ⅜ inch clusters.	All clover and alfalfa regions.	Hay, Clover, and alfalfa seed.	Clover and alfalfa fields.
Dogbane, Indian hemp (<i>Apocynum cannabinum</i>), P.	Greenish white; ¼ inch; terminal clusters.	Upper Mississippi Valley.	Wind; creeping root.	Fields with sandy soil; pasture, grain and hoed crops.
Fern, brake (<i>Pteridium aquilinum</i>), P.	No flowers.....	Northwestern States and the Pacific Coast	Spores scattered by wind; running roots.	Logged-off land, meadows, and pastures.
Fleabane, horesweed (<i>Eriogon canadensis</i>), A.	White; ¼ inch; heads in cymes.	Entire United States.	Hay, grass and, clover seeds.	Meadows, pastures, and grain fields.
Foxtail, yellow foxtail, pigeon grass (<i>Chaetochloa glauca</i>), A.	Green; Spikes.....	.....do.....	Animals, hay, grain, and grass seeds.	Land cultivated in early part of season; young grass and clover seedlings.
Hawkweed, orange hawkweed, devil's-paintbrush (<i>Hieracium aurantiacum</i>), P.	Orange; 1 inch; heads.	Maine to Ohio	Wind, grass and clover seeds; runners similar to strawberry.	Untillable pastures and meadows.
Ironweed (<i>Veronia noveboracensis</i>), P.	Purple; ½ inch; heads.	Maine to Maryland and Iowa to Kansas.	Wind; short thick rootstocks, making plant grow in bunches.	Pastures and meadows.
Jimson weed (<i>Datura stramonium</i>), A.	Purple; 3 inches; solitary.	Maine to Minnesota and Texas.	Pods and plants blown by wind.	Pastures, barnyards, and waste lands, seeds, flowers, and leaves poisonous.

Common name, botanical name, and duration of life.	Color, size, and arrangement of flowers.	Sections where injurious.	Method of seed distribution; vegetative propagation of the perennials.	Place of growth and products injured.
Johnson grass (<i>Holcus halepensis</i>), P.	Green; $\frac{1}{2}$ inch; panicle.	Virginia to Texas and California.	In hay, grain, and grass seed; running rootstocks.	All crops except hay.
Lamb's-quarters, pigweed (<i>Chenopodium album</i>), A.	Green; very small; panicle.	Entire United States.	Grain and grass seed.	Grain fields and hoed crops.
Lettuce, prickly lettuce (<i>Lactuca virosa</i>), A.	Yellow; $\frac{1}{2}$ inch; heads in panicles.	Ohio to Iowa, Utah to California.	Wind.....	Everywhere; all crops.
Mustard, wild mustard, charlock (<i>Brassica arvensis</i>), A.	Yellow; $\frac{1}{2}$ inch; racemes.	Maine to Washington.	Grain, grass, clover, and rape seeds.	Small-grain fields and meadows; grains.
Nut-grass, coco (<i>Cyperus rotundus</i>), P.	Brown; $\frac{1}{16}$ inch; spikelets.	Maryland to Florida and Texas.	Wind, nursery stock, hay and grass seed; tubers.	All soils; hoed crops.
Pennycress, Frenchweed (<i>Thlaspi arvense</i>), A.	White; $\frac{1}{8}$ inch; racemes.	North Dakota and Minnesota.	Wind.....	Grain fields and pastures; grain and dairy products.
Pigweed, redroot, careless weed (<i>Amaranthus retroflexus</i>), A.	Green; quite small; spikes in panicles.	Entire United States.	In grain and grass seeds; plants blown by wind.	Plowed land; hoed crops.
Plantain, buckhorn, rib-grass (<i>Plantago lanceolata</i>), P.	White; $\frac{1}{16}$ inch; spike.	.....do.....	Hay, clover and grass seed; spreads but slowly from a crown.	Everywhere; meadows, pastures, and lawns.
Poison ivy, poison oak (<i>Rhus toxicodendron</i>), P.	Greenish white; $\frac{1}{8}$ inch; panicles.	Entire United States.	Does not spread fast by seeds; running rootstocks.	Moist rich land; along fences; poisonous by contact.
Purslane, pusley (<i>Portulaca oleracea</i>), A.	Yellow; $\frac{1}{4}$ inch; solitary.	.....do.....	Tillage implements; has a long seeding period.	Rich Cultivated land, especially gardens; hoed crops.
Quack-grass, witch-grass (<i>Agropyron repens</i>), P.	Green; spike.....	Maine to Pennsylvania and Minnesota.	Seeds of grain and coarse grasses; creeping rootstocks.	All crops on the better soils; hoed crops.
Ragweed, smaller ragweed (<i>Ambrosia elatior</i>), A.	Yellow; $\frac{1}{4}$ inch; small heads on spikes.	Entire United States.	Wind carrying matured plants; in grain and red clover seed.	Everywhere, especially grain stubble; hoed crops and young grass seeding.
Russian thistle, tumbleweed (<i>Salsola pestifer</i>), A.	Purplish; $\frac{1}{2}$ inch; solitary.	Minnesota to Washington and southward.	Wind rolling matured plants.	Everywhere; small grain and hoed crops.
St.-John's-wort (<i>Hypericum perforatum</i>), P.	Yellow; $\frac{3}{8}$ inch; cymes.	Maine to North Carolina and Iowa.	In hay and grass seed; rootstocks.	Meadows, pastures, and waste places.
Smartweed (<i>Polygonum pennsylvanicum</i>), A.	Light rose; $\frac{1}{16}$ inch; racemes.	Maine to Minnesota, Florida, and Texas.	Wind Carrying matured plants.	Moist, rich soils; hoed crops and young grass seedings.
Smartweed, marsh smartweed, devil's-shoestring (<i>Polygonum muhlenbergii</i>), A.	Rose color; $\frac{1}{16}$ inch; spikes.	Indiana to Iowa.	Wind and farm machinery; rootstocks.	Wet land, prairie, and muck soils; hoed crops, hay, pasture.
Sorrel, sheep sorrel, horse sorrel (<i>Rumex acetosella</i>), P.	Red; $\frac{1}{8}$ inch; panicles.	Entire United States.	In clover seed; creeping roots.	Meadows and pastures.
Sow thistle, perennial sow thistle, field sow thistle (<i>Sonchus arvensis</i>), P.	Yellow; $\frac{3}{8}$ inch; heads.	Maine to Minnesota.	Wind, running rootstocks.	Grain fields and hoed crops.
Squirreltail grass, squirrel grass, foxtail, wild barley (<i>Hordeum jubatum</i>), A.	Green; spike with long bristly glumes.	Minnesota to Texas and California.	Hay, animals, wind.	Meadows and pastures barbed seeds produce sores on live stock.
Thistle, Canada thistle (<i>Cirsium arvense</i>), P.	Purple $\frac{3}{8}$ inch; heads.	Maine to Pennsylvania and Washington.	Wind, in alfalfa, clover and grass seeds.	All crops.
Thistle, common thistle, bull thistle (<i>Cirsium lanceolatum</i>), B.	Reddish purple; 1 inch; heads.	Maine to Virginia and Washington.	In foreign clover and alfalfa seed; carried by animals and wind.	Pastures, meadows, and winter wheat.
Wild carrot (<i>Daucus carota</i>) B.	White; very small; umbels.	Maine and Virginia to the Mississippi.	In seed oats.....	Meadows and pastures.
Wild oats (<i>Avenafatua</i>), A.	Green panicles; similar to oats.	Wisconsin to Washington.		Oat fields, lawns, injurious to stock.
Wild onion, garlic (<i>Allium vineale</i>), P.	Flowers rare; umbels with bulblets.	Rhode Island to Georgia and west to Missouri.	Seeds rare; bulblets carried in wheat; underground bulbs.	Everywhere; wheat and dairy products.
Winter cress, yellow rocket (<i>Barbarea vulgaris</i>), P.	Yellow; $\frac{1}{4}$ inch; racemes.	Maine to Virginia and westward.	In grain, clover, and grass seeds.	Grain fields, pastures, and meadows

NUMBER OF PLANTS TO THE ACRE

Dis. Apart.	No. Plants	Dis. Apart.	No. Plants	Dis. Apart.	No. Plants	Dis. Apart.	No. Plants
12 x 1 in.	522,720	25 x 18 in.	15,520	36 x 36 in.	4,840	60 x 60 in.	1,745
12 x 3 in.	174,240	30 x 1 in.	209,088	42 x 12 in.	12,446	8 x 1 ft.	5,445
12 x 12 in.	43,560	30 x 6 in.	34,848	42 x 24 in.	6,223	8 x 3 ft.	1,815
16 x 1 in.	392,040	30 x 12 in.	17,424	42 x 36 in.	4,148	8 x 8 ft.	680
18 x 1 in.	348,480	30 x 16 in.	13,068	48 x 12 in.	10,890	10 x 1 ft.	4,356
18 x 3 in.	116,160	30 x 20 in.	10,454	48 x 18 in.	7,790	10 x 6 ft.	726
18 x 12 in.	29,040	30 x 24 in.	8,712	48 x 24 in.	5,445	10 x 10 ft.	435
18 x 18 in.	19,360	30 x 30 in.	6,970	48 x 30 in.	4,356	12 x 1 ft.	3,630
20 x 1 in.	313,635	36 x 3 in.	58,080	48 x 36 in.	3,630	12 x 5 ft.	736
20 x 20 in.	15,681	36 x 12 in.	14,520	48 x 48 in.	2,723	12 x 12 ft.	302
24 x 24 in.	10,890	36 x 18 in.	9,680	60 x 36 in.	2,901	16 x 1 ft.	2,722
24 x 1 in.	261,360	36 x 24 in.	7,260	60 x 48 in.	2,178	16 x 16 ft.	170

QUANTITY OF SEED REQUIRED

	Quantity per Acre.		Quantity per Acre.
Alfalfa	8 to 12 lbs.	Rye Grass, Oat Grass, Fescue Grasses	30 lbs.
Alyske	6 to 8 lbs.	Orchard Grass	20 to 30 lbs.
Artichoke, 1 oz., to 500 plants	6 oz.	Hemp	25 to 30 lbs.
Asparagus, 1 oz. to 500 plants	1 lb.	Horse Radish Roots	15000 to 20000
Barley	100 lbs.	Kale, 1 oz. to 150 feet of drill	1 lb.
Beans, Dwarf, 1 lb. to 100 feet of drill	50 lbs.	Kale, Thousand Headed	2 to 3 lbs.
Beans, Tall, 1 lb. to 150 hills	25 lbs.	Kohlrabi, 1 oz. to 150 feet of drill	2 lbs.
Beet, Garden, 1 oz. to 50 feet of drill	5 lbs.	Kaffir Corn	8 to 12 lbs.
Beet, Sugar, 1 oz. to 50 feet of drill	5 lbs.	Leek, 1 oz. to 100 feet of drill	4 lbs.
Beet, Mangel Wurzel, 1 oz. to 50 feet of drill	5 lbs.	Lettuce, 1 oz. to 150 feet of drill	3 lbs.
Broccoli, 1 oz. to 2000 plants	4 oz.	Melon, Musk, 1 oz. to 60 hills	2 to 3 lbs.
Brussels Sprouts, 1 oz. to 2000 plants	4 oz.	Melon, Water, 1 oz. to 30 hills	3 to 4 lbs.
Broom Corn	6 to 8 lbs.	Millet	30 lbs.
Buckwheat	45 lbs.	Nasturtium, 1 oz. to 50 feet of drill	15 lbs.
Cabbage, 1 oz. to 1500 plants	½ lb.	Oats	90 lbs.
Carrot, 1 oz. to 125 feet of drill	3 lbs.	Okra, 1 oz. to 100 feet of drill	8 lbs.
Cauliflower, 1 oz. to 2000 plants	3 oz.	Onion, 1 oz. to 100 feet of drill	8 lbs.
Celery, 1 oz. to 5000 plants	1 lb.	Onion, for sets	30 to 80 lbs.
Cheat	100 lbs.	Onion Sets, 1 lb. to 75 feet of drill	400 lbs.
Chicory, 1 oz. to 100 feet of drill	4 lbs.	Parsley, 1 oz. to 300 feet of drill	3 lbs.
Clover, White and Alyske	6 to 10 lbs.	Parsnip, 1 oz. to 200 feet of drill	6 lbs.
Clover, White, for Lawns	25 to 100 lbs.	Peas, Garden, 1 lb. to 50 feet of drill	200 lbs.
Clover, Red, Mammoth and Crimson	8 to 12 lbs.	Peas, Field	100 lbs.
Collards, 1 oz. to 2000 plants	4 oz.	Pepper, 1 oz. to 100 plants	500 to 700 lbs.
Corn, Sweet, 1 lb. to 200 hills	152 lbs.	Potatoes	3 to 4 lbs.
Corn, Field	10 to 15 lbs.	Pumpkin, 1 oz. to 30 hills	3 to 4 lbs.
Corn, Fodder	40 lbs.	Radish, 1 oz. to 100 feet of drill	10 lbs.
Corn, Pop	5 to 10 lbs.	Rape, Dwarf Essex	3 to 5 lbs.
Corn, Wheat	80 to 100 lbs.	Rutabaga, 1 oz. to 150 feet of drill	2 lbs.
Cress, 1 lb. to 100 feet of drill	1 lb.	Rye	90 to 120 lbs.
Cucumber, 1 oz. to 60 hills	2 to 3 lbs.	Salsify, 1 oz. to 50 feet of drill	8 lbs.
Egg Plant, 1 oz. to 2000 plants	4 oz.	Speltz	100 lbs.
Endive, 1 oz. to 100 feet of drill	4 oz.t	Spinach, 1 oz. to 100 feet of drill	8 lbs.
Flax, for seed 30 lbs. to acre. For fiber	50 lbs.	Spurry	15 lbs.
Grass, Lawn, 1 lb. to 300 square ft.	145 lbs.	Squash, Summer, 1 oz. to 25 hills	3 lbs.
Grass, Kentucky Blue, Canadian Blue	20 lbs.	Squash, Winter, 1 oz. to 12 hills	4 lbs.
Timothy	8 to 12 lbs.	Sugar Cane	10 lbs.
Red Top, in chaff, 60 lbs. Solid	20 lbs.	Sunflower	8 lbs.
		Tobacco, 1 oz. to 10000 plants	3 oz.
		Tomato, 1 oz. to 2000 plants	4 oz.
		Turnip, 1 oz. to 150 feet of drill	2 lbs.
		Vetches, Spring	60 to 90 lbs.
		Vetches, Winter	30 to 40 lbs.
		Wheat	80 to 100 lbs.

USUAL DISTANCES FOR PLANTING

Beans, Bush, drills 2 to 3 feet apart.	Melon, Water, 7 to 8 feet each way.
Beans, Pole, 3 to 4 feet each way.	Onions, drills 14 to 20 inches apart.
Beets, Early, drills 12 to 18 inches apart.	Parsnip, drills 18 to 36 inches apart.
Beets, Late, drills 2 to 3 feet apart.	Peach Trees, 18 to 24 feet each way.
Blackberries, erect growing, 6 to 9 by 4 feet.	Pear Trees, standard, 20 to 25 feet each way.
Blackberries, Mammoth and Himalaya, 8 by 24 feet.	Pear Trees, Dwarf, 12 to 15 feet each way.
Cabbage, Early 16 by 30 inches.	Peas, drills 2 to 3 feet apart.
Cabbage, Late, 24 by 30 inches.	Pepper, 15 to 18 inches by 2 to 2½ feet.
Carrots, drills, 1 to 2 feet apart.	Plum Trees, 15 to 20 feet each way.
Corn, Sweet, 3 to 3½ feet by 9 to 24 inches.	Potatoes, 12 to 18 inches by 2½ to 3 feet.
Corn, Field, 3½ to 4 feet each way.	Pumpkin, 8 to 10 feet each way.
Cucumber, 4 to 5 feet each way.	Quince Trees, 15 feet each way.
Currants, 5 by 3 feet.	Radishes, drills 10 to 18 inches apart
Egg Plant, 3 by 3 feet.	Raspberries, 6 to 8 by 3 feet.
Lettuce, drills 18 inches apart.	Rhubarb, 2 to 4 feet by 4 feet.
Melon, Musk, 5 to 6 feet each way.	Salsify, drills 18 to 24 inches apart.
Celery, rows 3 to 4 feet, 6 inches in row.	Spinach, drills 12 to 18 inches apart.
Cherry Trees, 15 to 20 feet each way.	Squash, Bush, 3 to 4 feet by 4 feet.
Cauliflower, 2 by 2 to 2 by 3 feet.	Squash, Running, 12 feet each way.
Apple Trees, 20 to 30 feet each way	Strawberries, Hills, 36 by 18 inches.
Asparagus, 3 to 4 by 2 feet.	Strawberries, Matted Rows, 48 by 12 inches
Gooseberries, 5 by 3 feet.	Sweet Potatoes, 2 feet by 3 to 4 feet.
Grapes, 8 by 8 to 10 by 12 feet.	Tomato, 4 feet by 4 to 5 feet.

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