FODDER CROPS OF THE PUNJAB.

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THE FODDER CROPS OF THE PUNJAB.

CHAPTER I.—Food of Cattle.

Introductory.

1. From the nature of the country, agriculture must always be the chief occupation of the people of the Punjab. According to the recent census the population of the 29 districts was nearly 20 millions. In round figures the cultivated area in 1906-07 amounted to 28 million acres, and pasture lands including Government forests to 18 millions. The well-irrigated area was 5 million acres, dependent on quarter of a million masonry and from 30 to 40,000 *kachcha* wells. The area protected by canals was $6\frac{3}{4}$ millions of acres—an area to which large additions will be made. An area of 275,000 acres was recorded as *abi*, and the unirrigated area exceeded 16 million acres. According to the cattle census of 1909 there were in that year 2,169,000 ploughs and 288,000 carts. The horned cattle available for draft were—

4,247,000 bullocks, and

625,000 male buffaloes.

The former figures include bulls, and if we exclude animals used for breeding, we may say there are $4\frac{1}{2}$ millions of animals available to plough the land, work the wells, thresh the corn, draw the carts, and work sugar, oil and flour mills. Camels are used for ploughing to some extent in Hissar and Ferozepore, and in Rawalpindi a donkey or a cow is sometimes seen yoked with a bullock. The milch kine consisted of 3,384,000 cows and 2,241,000 buffaloes, and the young stock, male and female, was returned as amounting to 3,820,000. Female buffaloes are far more valuable than cows, and are steadily growing in favour. They are also coarser feeders. The only districts in which little attention is still paid to them are a group of four in the north-west of the province, Jhelum, Rawalpindi, Attock and Mianwali, and two of the south-western districts, Muzaffargarh and Dera Ghazi Khan (see for details statement I). Roughly there are $14\frac{1}{2}$ millions of horned cattle dependent for natural grazing on 18 million acres of waste, much of it of poor quality, which they have to share with 4 million sheep and $5\frac{1}{2}$ million goats. The large areas of waste are found in a few districts, mostly in the west of the province and in the hills. In the four plain districts of the Jullundur division the waste is only equal to 12 per cent. of the cultivation, in the Lahore division excluding Gujranwala it is 20, and in the Delhi division excluding Simla 21 per cent. The products of the waste are supplemented by those of the fallow and by the grasses and other plants weeded out of the cropped fields. It is obvious that in the Punjab a very large acreage must be devoted to raising food for cattle, and that fodder crops must be of vast importance. Broadly speaking, the province is now secure from widespread food famines, but fodder famines can still inflict enormous losses on the people.

Constituents of food.

2. The following extracts from Moreland's Agriculture of the United Provinces are worth quoting as an introduction to the subject :—

"This food is produced in the parent plant from the materials that it has collected from the soil or the air and passes into the developing seed ; large numbers of different substances are stored in this way by different plants, but they can be grouped in two main classes according as they do or do not contain combined nitrogen . . . . . The non-nitrogenous matter is usually either starch or oil, while the nitrogenous matter is in various forms which are known collectively as albuminoids or proteids . . . . . Animals are made up of precisely the same elementary substances as plants, though they require to consume these substances in different forms, and convert them into such things as skin, bones and muscles, not leaves, flowers, or seed. We have seen that the most important product of plants from the nutritive point of view are (1) starch and the various sugars, and (2) the proteids ; when speaking of animals it is more convenient to call these respectively work food and flesh food.

The first class supply energy which enables an animal to go on working, but the second class (which it will be remembered contain nitrogen) are essential to replace the wear and tear of substance that is constantly going on in an animal body; in order to feed an animal so as to get the best work out of it, it is necessary not only to see that the weight of food given is sufficient, but also that it contains a due proportion of flesh food. Now we have seen that most of the flesh food produced by plants is stored in the seeds, and very little of it in the leaves and stems*: it follows that when cattle are doing hard work they ought to receive a fair amount of seed or grain as well as fodder, and even when they are idle some grain should be given to keep them in really good health."

For further information about food and the nutritive value of different grains, Church's "Food Grains of India" may be consulted. It is worth while to note that a standard diet for human beings should contain albuminoids and starch in about the proportion of 1—5. This is very much the proportion in which they exist in wheat, but in the millets and maize the proportion is about 1—8, in rice about 1—11, and in mandwa 1—13. In pulses the proportion of albuminoids to starch is much higher than 1—5; hence the utility of such mixtures as rice and dál or bájra and moth khichri (porridge). The analyses of the chemical contents of the grain of different crops given in this note are taken from Professor Church's book. In paragraph 239 of his work on the "Improvement of Indian Agriculture" the late Dr. Voelcker remarked in 1893 that little was known as to the relative nutritive values of different fodders in India, and apparently this has so far not been remedied. No doubt the straw of the pulses generally contains more albuminoids than that of the cereals, and it is on this account that they are weight for weight more valuable as fodder.

Wild plants.

3. We are not here concerned with the wild plants which furnish food for cattle. The list of trees, shrubs and herbs on which they feed is a very long one. A large part of it is occupied with the names of grasses, and of leguminous trees, such as various species of acacia and the *dhak* (Butea frondosa) and herbs, such as *maina* or maini (Medicago denticulata), a near relation of lucerne. For information the following may be referred to:—

(*a*) Duthie's "Fodder Grasses of Northern India."

(*b*) Coldstream's "Grasses of the Southern Punjab."

(*c*) Duthie's four lists on pages 407-437 of volume III of the Dictionary of Economic Products.

It is probable that considerable additions could be made to the lists of flowering plants other than grasses.

The two best fodder grasses in the plains are *ánjan* or *dháman* (Pennisetum cenchroides), and *dúb*, *dútra*, or *khabbal* (Cynodon dactylon), and the most useful shrub is the *jhárberi* or malla (Zizyphus nummularia), the leaves of which, *pála*, are a very valuable food for milch kine.

Meaning of "fodder crops."

4. The food of cattle, so far as it is derived from crops, may be classified as consisting of—

(*a*) straw—Vern. "*chára*" or "*níra*";

(*b*) the roots and tops of certain cruciferous plants, such as turnips and carrots;

(*c*) gram;

(*d*) oil-cake—"*khal*" or "*khali*";

(*e*) cotton seeds—"*binola*" or "*varenwa*".

It is only with the first two that a note on fodder crops is directly concerned "Fodder" according to a dictionary definition is "food for cattle, horses, and sheep, as hay, straw, and other kinds of vegetables." This is somewhat vague. A good working definition would be "the food derived by live-stock from crops exclusive of the *ripe* grain." Thus the ripe grain of wheat, or *másh* or *jowár*

* See in this connection chemical analysis of grain and straw of jowár in paragraph 21.

is not fodder, but the leaves and stalks, and in the case of *másh* the broken pods left after threshing are fodder. Cotton-seed is not fodder, and according to our definition oil-cake is also excluded, because it is the refuse left after grain has been expressed from the ripe seeds of certain crops. The number of purely fodder crops in the Punjab is really very small consisting of some of the pulses and one or two other plants. But any account of fodder crops would be incomplete which did not notice the use as fodder of the straw of crops whose grain is mainly used as human food. And it will be convenient also to mention the crops from which oil-cake is derived, especially as the chief of them also supply green food and roots for cattle.

Classification of dry fodder.

5. Dry fodder may be broadly classified as—

(*a*) *bhúsa, bhús, bho,* or *bhon.* Broken straw of those cereals and pulses of which the straw is threshed with the grain. Of this there are two main divisions—

(1) *turi* or *sufed bhúsa,* which is the straw of wheat and barley, and

(2) *missa bhúsa,* which is the broken leaves, straw, and pods of *moth, múng, másh, masar,* and gram;

(*b*) *tánda* or stalks of maize, bájra and jowár, which are not threshed with the grain. These are usually fed to cattle after being chopped up into small pieces :

(*c*) *parál* or *paráli,* which is the straw of rice.

Cattle feeding in different parts of the Punjab.

6. Speaking generally, the people feed cows and still more buffaloes when in milk better than they do their plough and well bullocks. The *zamindars* of the cis-Suttlej districts are better stock-keepers than those of the Punjab proper. The care which a peasant in Rohtak bestows on his female buffalo is remarkable, and even in seasons of severe drought one sees them coming out of the village sleek and well favoured. The feeding of cattle on turnip roots is far more common in the western districts than elsewhere, and it is in the same districts that peas (churál and matar), and, so far as the plains are concerned, the inferior cereals, known as chína and swánk, are most in use. Some extracts and notes are appended regarding cattle-feeding in some—

(1) cis-Sutlej,

(2) trans-Sutlej,

districts.

A.—Cis-Sutlej districts.

Karnal (Gazetteer, edition of 1890, paragraph 222).

7. "The fodder of the autumn crops consists of the stalks (tánda) of the great millets and of maize, which are carefully stacked on end in a stack called *chhor*; of rice straw, which is merely piled up in a heap (*kunjra*); and of the *bhús* or broken straw of the pulses. The spring crops give *bhús* only, also called *turi* if of wheat or barley. * * * *

Stems of millet and maize are chopped up into small pieces (*sani* or *kuti*) before being given to the cattle. An ox doing ordinary work will eat 20 *sers* of grass and a *ser* of grain daily; if working at the sugar-mill or well-bucket, nearly twice that.....Of course the fodder varies according to the season. The mass of it consists of grass and straw of cereals; a little pulse straw is always added, and green food when obtainable. In the cold weather *methi* and rape and carrots, and at all times the weedings, are given to the cattle. Besides this, some cotton seed or oil-cake, or either *gwára, moth,* or gram, is daily given. The best fodder of all is the straw of the small pulses, and is called *missa*; after that that of wheat and barley called *turi*; after that the *jowár* stems or *chari*. *Bájra* stems are seldom given alone. They are chopped up and mixed with one-third of *múng* fodder, or, failing that, with some oil-

cake or peameal of gram. In famines the cattle will eat almost anything. The sacred *pipals* are stripped, and even the thorny *híns* (Capparis sepiaria) is cut up and given to the starving beasts. Where sugarcane is grown it is cut down to keep the bullocks alive."

Gurgaon (Gazetteer, page 109).

8. "The grazing on such waste as there is is supplemented by the grazing on cultivated lands lying fallow, but on the whole grazing is inadequate. In consequence the cattle have to be largely stall-fed, and considerable areas of crops are grown exclusively for fodder. *Chari*, *gwár*, and *kásni* are exclusively fodder crops, while of other crops most of the peas, carrots, and turnips, about one-quarter of the *sarson* and autumn pulses, and small quantities of barley and gram are given to the cattle. To these must be added the stalks of *jowár* and *bájra*, the straw of the autumn pulses and rabi cereals, cotton seed, oil-cake, and pála. In good years all the above sources supply the *zamindars* with an abundance of good fodder, but, if the rains fail, a dearth of fodder and terrible loss of cattle result. When fodder is scarce the cattle are fed on branches of trees, roots of *púla*, etc."

Rohtak (Gazetteer, paragraph 129).

9. "The cattle of the district are in some respects ill-cared for. They are left to stand in filthy enclosures (*neora* or *ugár*), ankle-deep in half-liquid manure. They are chiefly stall-fed, chopped *jowár* stalks (sani) being the principal fodder, while in season the top leaves of the cane will be mixed, or some green *sarson* toppings. Working stock will get half a *ser* to a *ser* of gram a day, and a little *gur*, and milch cattle also eat cotton seed (*binola*) and oil-cake (*khal*), while the straw of gwár (*phaliár*) and of *múng* and *úrd* (*patti*) and of gram (*khar*) are highly valued for cattle, and the wild *jhárberi* is given for its milk-producing qualities. Best fed and best tended is the buffalo, and every day the village urchins may be seen carefully washing them in the tanks. In the morning the cattle are turned out for exercise, and to pick up what they can in the waste ground of the village, but there are few patches of jungle which produce more than indifferent grass. When the crops are off the fields the stubble is grazed by all the cattle of the village.

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The *jowár* and *bájra* stalks of a good year are usually counted to be sufficient for the current and one following year, though in a rain-land village, where the area under these crops is larger, it will last rather longer. *Bájra* fodder is not used so long as the *jowár* lasts."

Ferozepore.

10. (Based on a note by Rai Bahadur Tilok Chand, Sub-Divisional Officer of Fazilka.) The cattle of the Uplands or Rohi are of the Hissar and Nagore breed, and much finer than those of the Bet. A *zamindar* with a pair of bullocks would usually also keep a cow, a female buffalo, and some calves. Their food would be as follows :—

No.	Months.	Grain.	Straw.
1	Baisakh (16th April—15th May) ...	No grain, except to milch cattle, which get *grain and oil-cake.*	Graze in stubble of wheat and gram.
2	Jeth (16th May—15th June) ...	*Khali* and grain to working and milch cattle.	*Bhúsa.*
3	Har to Asoj (16th June—15th October)	Two *sers* of gram or *gwára* daily to each working animal or to milch kine when pregnent or giving milk.	*Chari*, if available; otherwise *bhúsa.*
4	Katak and Magghar (16th October—15th December).	No grain, as *gwára* (see next column) is considered a rich food.	*Gwára.*
5	Poh and Magh (16th December—15th February).	As No. 1 ..	*Bhúsa.*
6	Phagan and Chait (16th February—15th April).	No grain ...	Green wheat (*khawiá*) or green gram.

Half-ground gram (*áta*) is generally used and it is often mixed with *bhúsa*. The grain of *gwára* is boiled before it is given to cattle. While cows and

* See paragraph 3.

buffaloes are in milk they get *khali* or oil-cake and *binola* or cotton seed. A cow gets half a ser of *khali* and one ser of *binola*, and a female buffalo twice these quantities. *Khali* is also sometimes given to working bullocks in Baisakh and Jeth when they are employed in threshing grain. It is supposed to be cooling. The oil-cake used in Ferozepore is til in winter and sarson or táramíra in summer. The milch kine are looked after very carefully in winter, and get gram or gwára as well as oil-cake and cotton seed. In the Bet the *zamindars* cannot afford to give their well bullocks much grain. But if they are in hard work and are getting weak, a *ser* of gram or wheat is given daily. This is generally done in the ploughing season for rabi crops (Asoj and Katak). Milch kine in the Bet do not get oil-cake or cotton seed, but they get a *ser* of grain daily for two or three months in the cold weather. The *zamindars*, when they run short of bhúsa, as often happens, use *sarr* grass (Saccharum ciliare), cut into small pieces mixed with green *chari*, *sarson*, *táramíra*, or green wheat (*cf.* paragraph 19 of Steedman's Settlement Report of Jhang). The Bet *zamindars* grow turnips as fodder, usually three *ghumaos* on each well, and feed the cattle on them for a month or a month and-a-half in Poh and Magh.

In the south of the Ferozepore district the camel is used for ploughing and riding as well as for carrying burdens. They get gram and gwár grain and the straw of *gwár*, *moth* and gram.

Ludhiana.

11. The feeding of bullocks is described in paragraph 131 of Mr. (now Sir Thomas) Gordon Walker's Settlement Report :—

"In the months of Baisakh, Jeth, Har (April—June) the cattle are fed on dry straw and grain, the new straw of the rabi coming in by the first of these months. This is the worst time for them, and the working cattle could not get on without the *ser* or two *sers* of grain that they get daily. In Sawan and Bhadon there is good grass in the waste if any is left, and in the fields intended for the next rabi, where it is allowed to grow till the time of the Sawan ploughing. The cattle are grazed on this, and it is also grubbed up and given to them in the stall, the grain being stopped. Cutting grass is the work in Jat villages of the women who are out all day in the fields, collecting bundles. The cattle have very light work in these two months, because the wells are not working; and between this and the new grass they put on condition. In Asoj and half of Katak (September to October) green fodder, either "*chari*" alone or mixed with *moth*, &c., is given; and this is perhaps the best time of the whole year for the cattle. At the end of Katak the "chari," &c., is cut and stored; and during Magghar, Poh, Magh, and Phagun the dry stalks of *chari*, maize, &c., are given, and, if necessary, straw. The straw is either white ("*sufed bhúsa*"), that of barley and wheat, or "*missa*," *i.e.*, of *moth*, *másh*, &c., coloured straw. The latter, especially the *moth* straw, is said to be very strengthening. In the month of Chait (March) patches of green fodder are grown at the wells, either "*metha*," "*senji*," &c., or carrots; and green wheat or barley is also given, but not commonly in an ordinary year."

The grain that is given is gram coarsely ground sprinkled on the turi. They are also given a little oil-cake.

Mr. Dunnett has supplied me with the following account of the feeding of milch kine in Ludhiana :—

"Milch cattle in this district are generously fed. The basis of their food is of course *turi* and the straw of pulses, and they get some of the maize stalks and the *metha*. But they are not usually allowed to have any of the *gwára*. That fodder is filling and improves the appearance, but is said to be in reality weakening and prejudicial to a good milk yield. *Turi* reinforced with grain, *khali*, and *binola* are given. The grain is always gram. *Jowár* grain causes swelling in the mouth and throat (I am merely repeating what is said), and gives little milk. The grain of pulses is hot, and dries up the milk. Frequently all three (gram, *binola* and *khali*) are mixed with the *turi*, but more usually *khali* is moistened and mixed with *turi*, and gram *áta* is then sprinkled over it. The calculation is that gram is feeding and strengthening, while *khali* and *binola* improve the quantity of milk and increase the percentage of butter. A little *gur* is sometimes given. Only the eastern half of the district grows cotton to any extent; all the cotton is sold in Khanna, and the *binola* has to be brought back from the factories. The people of the western half of the district get *binola* from Khanna and Ludhiana, and consequently do not feed it freely to the cattle."

B.—Trans-Sutlej districts.

Jullundur (Gazetteer, pages 196-97).

12. "During Baisakh, Jeth and Har (middle of April to middle of July) the broken straw of wheat is the principal food (of the cattle). Broken barley, *massar*, and gram straw may also be given, but barley

and *massar* are little grown. *Senji* is occasionally stored, and, when this is the case, it is given to the cattle during these months. During the next two months (Sawan—Bhadon) there is plenty of grass in uncultivated plots and in fields lying fallow. This is grazed and also dug up and brought home for the cattle. Next month (Asoj, 16th September—15th October) green *chari* alone, or mixed with *moth* or *múng*, comes in and supplies food for nearly two months. About the end of October the chari left is cut down and stacked, and for the next four months it forms the principal food, being supplemented by maize stalks and, as soon as the cane crushing begins, about the end of November, by the arrow of the canes, which is fed mixed with broken straw. During February and March green fodder crops as *methi*, *senji*, and *hálon* are cut down as needed, and given to cattle in the same way as cane tops were previously. If the rains hold off, the people are put to great straits to feed their cattle; sugar-cane is cut for this purpose, but it is a poor fodder and does not suit for any length of time; the leaves of the dhak tree (Butea frondosa) are extensively used on such occasions..... When cows and buffaloes are about to calve and when they are in milk they often get grain, cotton seed, and oil-cake, but the amount depends on the owner's means, and nothing can be said about the quantity."

Lahore.

13. The following dietary for the canal-irrigated tract in the Lahore Manjha has been supplied by Rai Bahadur Hotu Singh :—

Month.	Grain.	Straw.
October	Bullock ... 2 *sers*, whole gram...	Bullock—10 *sers bhúsa* mixed with whole gram or 30 *sers* of *chari* mixed with *gwára*, *moth* or *múng* green.
	Cow ... 1 *ser* gram ... / 1 *ser binola* ...	Cow—5 *sers bhúsa* and 20 *sers* green, *chari* and *gwára*, *moth* or *múng*.
	Buffalo ... 4 *sers binola* ... / 1 *ser khali* ...	Buffalo—15 *sers bhúsa*, 20 *sers chari* and *gwára*, *moth* or *múng*.
November	Bullock ... None	Bullock—15 *sers bhúsa* and 30 *sers* dry *chari*.
	Cow ... 1 *ser binola* ... / 1 *ser* grain ...	Cow—5 *sers bhúsa* and 20 *sers* dry *chari*.
	Buffalo ... 4 *sers binola* ... / 1 *ser khali* ...	Buffalo—20 *sers bhúsa*, 20 *sers chari*.
December	As in November, but bullocks get grain in first 15 days.	As in November.
January...	Bullock ... None	Bullock—20 *sers bhúsa* and 20 *sers* turnips or *sarson*.
	Cow ... 1 *ser binola* ... / 1 *ser* grain ...	Cow—5 *sers bhúsa* and 15 *sers* green *sarson*.
	Buffalo ... 4 *sers binola* ... / 1 *ser khali* ...	Buffalo—20 *sers bhúsa* and 20 *sers* green *sarson*.
February	Bullock ... None	Bullock—15 *sers bhúsa* and 60 *sers senji* or green barley.
	Cow ... 1 *ser binola* ...	Cow—5 *sers bhúsa* and 25 *sers senji* or barley.
	Buffalo as in January... ...	Buffalo—20 *sers bhúsa* and 20 *sers senji* or barley.
March	Bullock ... None	Bullock—60 *sers* green *senji*, barley, wheat or gram.
	Cow ... None	Cow—40 *sers* of above.
	Buffalo ... 1 *ser binola* ... / 2 *sers* grain ...	Buffalo—10 *sers bhúsa* and 40 *sers* green, wheat, gram or *senji*.

Month.	Grain.		Straw.
April	Bullock ...	None	Bullock—60 *sers* green gram.
	Cow ...	None	Cow—30 *sers* green gram.
	Buffalo ...	4 *sers binola* ... 1 *ser khali* ...	Buffalo—5 *sers bhúsa* and 20 *sers* green gram.
May and June	Bullock ...	2½ *sers* grain ... ½ *ser khali* ...	Bullock—30 *sers bhúsa.*
	Cow ...	1 *ser* grain ...	Cow—15 *sers bhúsa.*
	Buffalo ...	4 *sers binola* ... 1 *ser khali* ...	Buffalo—20 *sers bhúsa.*
July	Bullock ...	2 *sers* grain ...	Bullock—15 *sers bhúsa* and 20 *sers* early-sown green *chari.*
	Cow ...	1 *ser* grain ...	Cow—5 *sers bhúsa* and 10 *sers* early sown *moth.*
	Buffalo ...	4 *sers binola* ... 1 *ser khali* ...	Buffalo—15 *sers bhúsa* and 30 *sers chari* and *moth.*
August and September ...	Bullock ...	None ...	Bullock—5 *sers bhúsa* and 40 *sers* green *chari* and *gwára.*
	Cow ...	None ...	Cow—20 *sers* green *chari.*
	Buffalo ...	None ...	Buffalo—10 *sers bhúsa* and 45 *sers chari* and *gwára.*

14. Rai Bahadur Hira Singh, Revenue Assistant of Gujrat, has supplied the following dietary for that district. It represents the food an ordinary small farmer would give to his cattle. Milch kine get the first three items when in milk :—

Gujrat.

Month.	Grain.	Cotton seed.	Oil-cake.	Fodder.
	Sers.	Sers.	Sers.	
1. Jeth, Har and first fortnight of Sawan (16th May—31st July).	Cow 1 Buffalo 2	...	Bullock ½ Cow ½ Buffalo 1	*Turi* mixed with the oil-cake and *binola* in *bárání*, and with early *jowár* and *makki* when available in *cháhi* villages.
2. Second fortnight of Sawan and Bhadon (1st August—15th September).	*Nil*	*Nil*	*Nil*	As grass is available, no grain, &c., or straw given.
3. Asoj (16th September—15th October).	Bullock 1 as employed in ploughing.	*Nil*	*Nil*	Grass and *chari.*
4. Katak (16th October—15th November).	*Nil*	*Nil*	*Nil*	Grass, *chari, moth, bájra.* As green fodder with grain is available, no other grain or oil-cake is given.
5. Magghar (16th November—15th December).	Cow 1 Buffalo 2	Buffalo 1	Cow Buffalo 1	Bullocks—*turi* mixed with *moth.* Milch kine—*turi* and stalks of maize, *jowár* and *bájra* mixed.
6. Poh (16th December to 15th January).	Ditto	Ditto	Ditto	As in No. 5. But *sarson* also becomes available, and in *cháhi* villages turnips.
7. Magh, first fortnight (16th—31st January).	Ditto	Ditto	Ditto	Green *sarson* and *kusumbh* and green wheat to some extent mixed with *turi.*
8. Magh, second fortnight (1st—15th February).	*Nil*	*Nil*	*Nil*	As in No. 7.
9. Phagan (16th February—15th March).	*Nil*	*Nil*	*Nil*	Green wheat and *kusumbh.* Little or no grain, &c., given.
10. Chait and first fortnight of Baisakh (16th March—30th April).	*Nil*	*Nil*	*Nil*	Green wheat and barley in first fortnight of Chait; afterwards green gram, *masar,* and barley with the grain.
11. Baisakh, second fortnight (1st—15th May).	Cow ... 1 Buffalo ... 2	...	...	Green fodder being exhausted, grain given to milch kine. Bullocks get *bhúsa* of *jaunsri.* Milch kine graze in the reaped fields and at night get *turi* mixed with their grain ration.

15. The livestock of the Rawalpindi district, both oxen and cows, is of very poor quality and little regarded. "In April, May and June plough bullocks get *bhúsa* or chopped straw, and while in work half a ser of *khal* or oil-cake. Bullocks used as beasts of burden usually get a small feed of grain daily as well. In July and August they are fed on green grass, and from September to March on the straw of autumn crops known as *tánda* (*jowár* and *bájra*) and *missa* (the straw of *moth*). Favourite and valuable animals are also occasionally allowed to graze in *jowár* and *moth* fields when the crops are still young. *Sarson* and occasionally young wheat are also used as fodder for bullocks. In the hills more grass is used and less of other kinds of fodder."

Rawalpindi (Gazetteer).

16. When not in milk a cow is left to shift for herself pretty much, going out with the cattle of the village to graze. However when in milk, if the owner is fairly off and she has not many rivals, she will get some boiled cotton seed (*varenva*), about 1¼ *ser* per diem in Poh, and in Jeth and Har as much ground gram or barley soaked in water, and will in other respects be treated as her owner's bullocks, sharing with them and the buffaloes the oil-cake (*khal*) he may possess. As a rule a cow is well off, if she gets some chopped straw in addition to what she can pick up in the fields . . . . . Bullocks are fed four times a day, in the morning and evening, at noon, and before the owner goes to bed. They very seldom get any grain, if ever, but they may come in for some raw cotton seed in Poh. . . . A bullock will eat from 12 to 15 *sers* of broken straw per diem, or about double that quantity of green fodder. Its food consists chiefly of broken straw of sorts, turnips, *chari*, green wheat, and dry *jowár* stalks. Its food during the year commencing with Chaitr or the middle of March may be taken as follows:—

Montgomery (Purser's Settlement Report, pages 76-8).

Chaitr	...	Green wheat, *methra*, carrots (rare).
Baisakh	...	Wheat straw, dry *turi*, grazes in stubble fields.
Har	...	Ditto. If there has been rain, the bullocks are turned out to graze.
Sawan-Bhadon	...	Graze as before. If there has been no rain, *turi*, *chari* or *china* sown in Jeth, and kept over is given.
Asoj	...	*Kangni* straw or *chari* sown in Sawan.
Katak	...	*Chari* sown in Sawan or straw of *china* sown in Bhadon. Bullocks also graze in stubble fields.
Magghar	...	*Chari* or *china* straw. Also rice straw, if available.
Poh	...	*Turi* mixed with green wheat. Tops of turnips.
Magh	...	*Turi* mixed with green wheat and roots of turnips.
Phagan	...	Green wheat, turnips and *methra* at the end of the month.

. . . . . It is not uncommon on the Ravi to turn the cattle out into the young fields of gram, *massar*, etc., to graze.

17. In an ordinary holding in this district the well cattle will be fed in April on peas or *methra*, and, as the wheat is cut, they get grazing in the stubble; in May and June they graze in the wheat stubble or get fed on *china* or pea straw; in July they get the early *jowár* and wheat straw is also available; from August to December they get *jowár* or green grass or *bájra* stalks, and when green food is not available, then wheat straw or dried *jowár* is given to them. With December begins the turnip season, and as the turnips give out, green wheat is supplied as far as necessary, or the cattle receive peas and

Multan (Gazetteer, edition 1901-02, pages 225-26).

methra until the wheat crop is cut in April. During a large part of the year therefore the well cattle are stall-fed; and it is as a rule only when there is wheat stubble or peas or fresh grass on the ground that they get anything like sufficient grazing. In addition to the peas, wheat, *chína*, *jowár*, and turnips above mentioned there are several other crops used wholly or partly for fodder, such as *rawán*, *másh*, *masar*, gram, *senji*, *methra*, and *swánk*. Sometimes crops, such as *jowár* and turnips, shrivel up when young and become actually poisonous to cattle; this is called *patha lagna*. Cattle can graze freely among indigo plants, so long as they have not begun to seed, without injuring the crop."

Multan and Muzaffargarh (based on a note by Rai Bahadur Tilok Chand).

18. The food of plough and well oxen is—

Months.	Grain.	Fodder.
Baisakh and Jeth	Half to 1 *ser* of *khali* daily ...	*Bhúsa.*
Har to Asoj	None	*Chari, jowár, moth,* if available; otherwise *bhúsa.*
Katak and Magghar ...	One *ser* of gram or wheat to each working bullock.	*Chari,* if available; otherwise *bhúsa, senji* fodder in second fortnight of Magbar, if available.
Poh and Magh	One *ser* of *binola* to working cattle, if they seem weak.	*Senji.* Turnips alone or mixed with *sarr* grass or *bhúsa.*
Phagan and Chait	None	Green wheat mixed in first fortnight of Phagan with *sarr* grass or *bhúsa.*

While in milk a cow gets half a *ser* of oil-cake and a *ser* of grain, and a female buffalo double these quantities. In Poh and Magh when fed on turnips a cow gets a *ser* of *binola* and a milch buffalo 2 *sers*.

CHAPTER II.—Cereals.

Cereals and pulses.

19. In temperate climates grasses or flowering plants of the natural order Gramineæ occupy the land to an extent far exceeding any other class of herbs. Probably plants of the order Leguminosæ occupy the second place. It is a striking fact that grasses (cereals) and leguminous plants (pulses) supply all that is necessary to man and beast for food except in very cold climates, and that the two classes supplement each other, the element which is in defect in most cereals being in excess in the pulses. This chapter and the next deal with the cereals and pulses which supply food to cattle.

Makki, synonyms *chalian, kukri, jowár* (Jullundur).

20. *Zea mays: natural order Gramineæ.*—For botanical description see Fuller and Duthie's Field and Garden Crops of the North-Western Provinces, part I, page 21, and plate V.

Chemical composition of grain—

	Per cent.
Water	12·5
Albuminoids	9·5
Starch...	70·7
Oil	3·6
Fibre	2·0
Ash	1·7

The dry stalks, *karbi*, are only indifferent fodder, and should be mixed with green food. Purser notes on page 178 of the Jullundur Gazetteer—"when ripe the leaves and thinner parts of the stalk are fair fodder, but inferior to *jowár*. The harder parts of the stalk are rejected by cattle, and

are good only for fuel and manure. The green plant is good fodder, and well-to-do zamindars sometimes sow maize thick like *chari* in order to supply green food to the cattle in the hot weather. "It is then sown very early in the hot weather." The area under maize in kharif 1910 was 1,206,645 acres. The districts having the largest acreage were—

	Acres.
Kangra	165,452
Hoshiarpur	161,149
Ambala	96,283
Jullundur	85,929
Sialkot	79,234
Gurdaspur	72,992
Lyallpur	70,752

Jowár.

21. *Sorghum vulgare*: *natural order*, *Gramineæ*.—For botanical description see Field and Garden Crops, page 25, and plate VI.

Chemical composition of grain—

	Per cent.
Water	12·5
Albuminoids	9·3
Starch	72·3
Oil	2·0
Fibre	2·2
Ash	1·7

Dr. Voelcker's analysis of the straw, which shows that it is more nourishing than turnips (see paragraph 59), as given in Field and Garden Crops, is as follows:—

	Per cent.
Water	85·17
Flesh forming matters	2·55
Fatty and heat producing matters	11·14
Inorganic matters	1·14

If *jowár* is grown for grain, it is sown sparsely, 8 to 12 *sers* of seed being used to the acre. If fodder (*chari*) only is wanted, 30 to 40 *sers* will be used. In Gurgaon it is sometimes sown moderately thick so as to secure some grain as well as the *chari*, and then 15 *sers* of seed go to the acre. *Jowár* is grown largely for grain in the five southern districts of the Delhi division, and in some districts of the Multan division, especially Dera Ghazi Khan. Except in Dera Ghazi Khan the grain is little used as a food for cattle and horses. The dry stalks (*tánda*, *karbi*) are excellent fodder, and are usually chopped up and mixed with the *bhúsa* of kharif pulses, etc. In Lahore "if fodder is plentiful, the stalks are thrown down whole, and the cattle eat half, leaving the harder ends.' If owing to drought the plant withers, it is very dangerous for cattle, and to eat it may have fatal results. In Hissar the husks (*boda*), after the grain has been beaten out, are fed to cattle, mixed with *pála*. The stalks when green contain a good deal of sugar and are much appreciated as fodder. Part of the crop is cut in October while still green. A variety known as "mithi jowár" is mentioned in the Gazetteer of the Lower Chenab Canal Colony, page 82, "which is eaten with avidity by cattle, while its stalks are chewed like sugarcane by the Janglis, who call it *ganna* (cane)." In some districts some *jowár* is sown thickly on irrigated land very early in the hot weather so as to secure a supply of green food in June and July. This is called *Hárí* or *Hárú*. The ordinary sowing season is July. Owing to the way in which *jowár* is cultivated it is difficult to place very great reliance

on the areas returned as under *jowár* and *chari* respectively. According to statement II the areas sown with *jowár* and *chari* respectively in kharif 1910 were—

	Acres.
Jowár	1,342,870
Chari	1,485,345

The figures under *chari* may include a certain amount of other fodder crops. The districts in which *jowár* is grown largely for grain are the five southern districts of the Delhi division, Ferozepore, the districts of the Rawalpindi division (except Jhelum), north of the Salt Range, Jhang, Multan, and Dera Ghazi Khan.

Sorghum halepense—*baru*—is a fodder grass which when it dries up has the same poisonous properties as its cultivated relation (Fodder Grasses of Northern India, pages 40-41).

Bájra, synonym *bájri*.

22. *Pennisetum typhoideum* : *natural order, Gramineæ.*—For botanical description see Field and Garden Crops, part I, page 30, and plate VII.

Chemical composition of unhusked grain—

	Per cent.
Water	11·3
Albuminoids	10·4
Starch	71·5
Oil	3·3
Fibre	1·5
Ash	2·0

The grain is considered excellent food for men, and in Gujrat some of it is given to bullocks. As fodder the stalks are distinctly inferior to those of *jowár*, and in some parts, if other fodder is abundant, only the heads are cut off and the stalks are left standing. In Karnal they are called *dandar* and in Hissar *karbi*. They are chopped up and given to the cattle mixed with green stuff or with gram *áta*. Before the Sirsa Branch of the Western Jumna Canal began to irrigate the southern part of the Kaithal tahsil, it used to be a common sight there to see in the *barani* fields large ricks (*chhor*) of *bájra* stalks black with age preserved as a reserve against fodder famines. In some of the north-western districts the stalks of *bájra* are a very important part of the fodder supply.

The area returned as under *bájra* in kharif 1910 was 2,412,497 acres. Of this 1,173,585 acres were in the Hissar, Rohtak and Gurgaon districts of the Delhi division, Hissar alone accounting for nearly 700,000 acres, and 792,106 acres were in the six districts of the Rawalpindi division.

Bájra is a near relation of *anjan* or *dháman* (Pennisetum cenchroides), the best of the uncultivated fodder grasses in the Punjab.

Kangni, synonym *kanni* (Simla).

23. *Setaria Italica* : *natural order, Gramineæ.*—For botanical description see Field and Garden Crops, part II, page 5, and plate XXV.

The chemical composition of the husked grain is—

	Per cent.
Water	10·2
Albuminoids	10·8
Starch	73·4
Oil	2·9
Fibre	1·5
Ash	1·2

This inferior kharif millet is grown more or less in all districts, but except in the hills and submontane tracts and in parts of the Multan division

the areas are generally insignificant. Mr. Purser wrote on page 115 of the Montgomery Settlement Report :—

"Two varieties of this crop are recognized, *kangan* and *kangni*, but they differ only in size, as *kangan* is larger and coarser than *kangni*. *Kangan* is rare. The straw . . . . *is* called *parál* or *paráli*. It is not broken up like *turi*. It is considered good strengthening food. The grain . . . . *is* used as an article of diet."

In Jhang "patches are grown on wells for fodder by *zamindars* who keep horses, but the grain is seldom threshed." In Lahore *kangni* is grown sometimes for fodder and sometimes for grain, and the fodder is considered good. In the Simla Hills it is sown in poor lands, and the grain is boiled and eaten like rice, while the straw is fed to cattle during the winter.

Chína.

24. *Panicum miliaceum* : *natural order, Gramineæ.*—For botanical description see Field and Garden Crops, part II, page 1, and plate XXIII.

The chemical composition of the husked grain is—

	Per cent.
Water	12·0
Albuminoids	12·6
Starch	69·4
Oil	3·6
Fibre	1·0
Ash	1·4

Outside the hills and one or two of the south-western districts this is a very unimportant crop. As regards its cultivation in Jhang and Multan the following extracts may be given—

Steedman's Settlement Report of Jhang, page 94—

"*China* as a crop is largely grown on well lands. Two crops are reaped in the year, the first in Jeth and Har, the second in Magghar . . . . *China* requires a large quantity of water . . . . . The first *china* crop is used chiefly as fodder. It is very rarely threshed. The second *china* crop comes in useful for the wheat sowings. The crop is sometimes pulled up or cut half ripe, as much grain beaten out as can be, and the straw used for fodder. More generally the second crop is allowed to ripen . . . . If there have been good rains and grass is plentiful, the whole of the *china* will be allowed to ripen ; if there has been but little rain and grass is scant, the whole crop may be used as fodder."

Multan Gazetter, edition of 1901-02—

"*China* is a crop which has nearly trebled in area since 1880 and now represents 1·5 per cent. of the cropping of the district. This increase is entirely due to its popularity on the Sidhnai Canal, where it has been extensively grown both in the *zaid* rabi and in the kharif harvest, about one-third being shown in the revenue records against the former . . . . . The crop is mainly used for food, but a certain portion of the *zaid* rabi is employed as fodder also. As a food the grain is inferior . . . It provides the poorer classes with a cheap if somewhat distasteful food."

In Simla the straw is fed to cattle in the winter. In 1910-11 the area under *kangni* and *china* amounted to about 56,000 acres, *china* being the more important crop. The only districts in which the area under *kangni* exceeded 1,000 acres were—

	Acres.
Sialkot	3,395
Kangra	2,920
Rawalpindi	1,538

Sánwak, synonym *swánk, samúkha, jhandru* (Kangra).

25. *Panicum frumentaceum* : *natural order, Gramineæ.*—For botanical description see Field and Garden Crops, part II, page 3, and plate XXIV.

For chemical composition of unhusked grain see Church's "Food-grains of India," page 49.

In Gujrat *kangni* and *swánk* are mixed with maize crops on well lands and ripen before the maize.

In Jhang *sánwak* is grown to a small extent for horse fodder on wells. In Muzaffargarh it is grown on canal and well lands, mostly as a food crop, but it is sometimes used green for fodder. This millet is also grown in hill districts. In the Dictionary of Economic Products, volume VI, part I, page 9, the quick-growing *sailáb* crop, *samúkha*, sown in Jhang, Mianwali and Muzaffargarh in land newly left by the river, is treated as the same plant as *sánwak*, but possibly this may be a mistake. Pandit Hari Kishan Kaul, has informed me that the main difference is that *samúkha* has a black seed, while that of *sánwak* is white. *Samúkha* may perhaps be one of the panicums mentioned below. The account of its cultivation given on page 106 of the Muzaffargarh Gazetteer may be quoted:—

"As the rivers recede in August and September they leave large flats of quicksand or rather quick-mud, which will not support a man. The sower taking a *ghara* of seed enter as the mud, supporting himself on the *ghara*, and scatters the seed over the mud. As the mud dries the plant springs up and produces grain in October. The grain is small and inferior. Kirars eat it on fast days. The straw is considered excellent fodder."

Samúkha is grown mostly for fodder. The crop returns for 1910-11 show 2,500 acres as under *sánwak* in Gujranwala and 1,019 in Gujrat. In Kangra *sánwak* is included in an area of 14,475 acres shown as under "Other cereals." Jhang returned 2,453 acres of *sánwak* and 491 of *samúkha*, Mianwali 46 of *sánwak* and 504 of *samúkha*, and Muzaffargarh 790 of *samúkha*.

The wild grass, *sánwak*—Panicum colonum, is useful fodder when it is young, and Hindus eat the grain on fast days (Hissar Gazetteer, page 10, and Karnal Gazetteer, edition of 1890, page 22). Panicum crus-galli, called *bharti* in the Hissar district, is also a fodder grass. If the crop described as *shámákh* in the crop returns of the Hoshiarpur district, and which there occupied in kharif 1910 an area of 3,146 acres, is not Panicum frumentaceum, it may be a cultivated variety of one of these wild panicums.

Kuria.

26. *Panicum helopus: natural order, Gramineæ.*—For botanical description see Duthie's "Fodder Grasses of Northern India," page 8. Duthie states that it is an excellent fodder grass for both horses and cattle, and that it is found chiefly on cultivated ground in the plains, and occurs on the Himalaya up to about 5,000 feet. It is cultivated to a small extent on well lands in Jhang and Muzaffargarh, and is used as fodder for horses.

Guinea grass.

27. *Panicum jumentorum*, a native of tropical Africa, is a rich fodder grass. It is best propagated by dividing the roots. It has been cultivated experimentally in the Punjab, but has not become an established fodder crop.

Dhán.

28. *Oryza sativa: natural order, Gramineæ.*—For botanical description see Field and Garden Crops, part I, page 15, and plate IV.

Chemical composition of husked grain is—

	Per cent.
Water	12·8
Albuminoids	7·3
Starch	78·3
Oil	·6
Fibre	·4
Ash	·6

The straw is called *parál* or *paráli*. It is not threshed with the grain. As fodder the straw is very poor, but in rice tracts it is given to the cattle *faute de mieux*. It ought to be reinforced with green stuff. In Karnal the *paráli* of

the coarse *sánthi* rice is said to be better fodder than that of the fine *zírí* rice. It is noted that when, owing to want of water, the crop produces no grain, the straw, which is then known as *marain*, is an "excellent fodder" (Hissar Gazetteer, page 173). The area under the many varieties of rice was returned in kharif 1910 as 712,843 acres. The districts having the largest acreage under this crop were—

	Acres.
Kangra	119,995
Sialkot	64,800
Dera Ghazi Khan	63,588
Ambala	61,984
Gujranwala	59,606
Gurdaspur	50,707
Muzaffargarh	47,963
Karnal	47,153

Mandwa, synonyms, *mandal, koda, chalodhra* (Gujrat), *mandan* (small variety).

29. *Eleusine coracana : natural order, Gramineæ.*—For botanical description see Food and Garden Crops, part II, page 10, and plate XXVIII. Chemical composition of husked grain—

	Per cent.
Water	13·2
Albuminoids	7·3
Starch	73·2
Oil	1·5
Fibre	2·5
Ash	2·3

Under the name of *rágí* it is largely grown as a food crop in Southern India. The total area in the Punjab in kharif 1910 was returned as 22,035 acres, and two-thirds of this came from the hill districts of Kangra and Simla. The only other districts with areas exceeding 1,000 acres were Karnal (1,220), Sialkot (1,444), and Rawalpindi (1,460). The grain is very inferior food, but useful to poor people. According to the Simla Gazetteer, page 66, the straw is fed to cattle and "is said to be very sweet." In Karnal its cultivation as a dry crop expands a good deal in dry seasons, as it is sown in fields intended for the fine *ziri* rice, when the latter cannot be planted out owing to the drought. There "the *bhús* is very bad fodder, and is generally burnt as it stands or grazed down" (Gazetteer, edition of 1890, page 204). The wild grass, Eleusine flagellifera, which is the *chhimbar* of the Western Punjab, and the *gathíl* of Karnal, is a useful fodder plant. Other wild species of eleusine, which are fodder grasses, will be found noted on pages 56-9 of Duthie's "Fodder Grasses of Northern India."

Kodra.

30. *Paspalum scrobiculatum : natural order, Gramineæ.*—For botanical description see Field and Fodder Crops, part II, page 8, and plate XXVII. The chemical composition of the husked grain is given on page 40 of the "Food Grains of India."

This poor millet is a favourite crop in parts of the United Provinces and is grown there on inferior outlying lands. It appears to be grown to some extent in the Simla Hills and elsewhere (Punjab Products, page 238), and may be confused in our returns with *koda* (Eleusine coracana). In the list of crops on page 116 of the Hoshiarpur Gazetteer *mandal* (Eleusine coracana) and *kodra* are shown separately, but the botanical name of *kodra* is also given as Eleusine coracana. It is stated on page 1 of Duthie's "Fodder Grasses of Northern India" that the grain is chiefly consumed by the lower classes, and that the straw is used as fodder.

31. *Triticum sativum : natural order, Gramineæ.*—For botanical description see Fuller and Duthie, Food and Garden Crops, part I, page 1, and plates I-A and I-B.

Kanak, synonym *gehun* (in eastern districts).

The average chemical composition of the grain of Indian wheats is—

	Per cent.
Water	12·5
Albuminoids	13 5
Starch	68·4
Oil	1·2
Fibre	2·7
Ash	1·7

The grain is too valuable to be used much as food for cattle.

It is sometimes given to milch kine. The uses as fodder of the dry broken straw or *turi* have already been indicated. The ways in which it is stored may be gathered from the following extracts :—

Karnal Gazetteer, edition of 1890, *paragraph* 222.—" *Bhús* is stored in a *kup* made of a wisp of straw wound spirally round and round upon a foundation of cotton stems so as to form a high circular receptacle in which the *bhús* is packed and preserved, and thatched when full. A long low stack fenced in by cotton stems alone is called a *chhan* or *bhúsarí*. Near the city the people store their *bhús* in mud receptacles (*khuta*) and plaster it all round the top. The *bhús* is taken out from a hole at the bottom as wanted."

Chenab Colony Gazetteer, page 80.—*Bhúsa* " is stored in stacks, *músal*, or in low heaps, *dhar*. The *músal* is built up in the form of a haystack and better withstands the rain owing to its sloping thatch. But the *dhar* is often preferred because it is less exposed to damage from fire. An enemy can burn a *músal* down, whereas a *dhar* will only smoulder at one end."

Multan Gazetteer, page 219.—" The wheat straw is collected in stacks, *palle*, and surrounded with wattles or cotton stalks and daubed over with mud."

Near towns the green wheat when in ear (*khawíd*) is cut down and fetches a very good price. In some of the western districts much wheat on the wells is cut down green to feed the bullocks, the amount which has to be sacrificed depending of course on the nature of the season.

Thus the late Mr. Steedman wrote in paragraph 131 of the Jhang Settlement Report :—

" Practically the tenant can cut as much green wheat and *jowár* to feed the well bullocks as is necessary. There is really no limit. Similarly, the whole of the turnip crop is his. It is only where the crop or roots are sold that the proprietor takes a share ; otherwise all (of the fodder) that he takes is a *marla* or two of green wheat and a bundle or two of turnips."

In rabi 1910 the area under wheat was 8,884,697 acres, distributed among the divisions as follows :—

Division.	Acres.	Per cent. of total cropped area of both harvests.
Delhi	892,721	11·8
Jullundur	1,662,321	29·9
Lahore	2,024,376	38·5
Rawalpindi	2,127,265	43·7
Multan	2,178,014	40·8
Total	8,884,697	31·1

These figures show the enormous importance of wheat straw as a source of fodder in the three western divisions.

Jau.

32. *Hordeum vulgare : natural order, Gramineæ.*—For botanical description of barley see Field and Garden Crops, part I, page 9, and plate II. The chemical analysis of the husked grain is—

	Per cent.
Water	12·5
Albuminoids	11·5
Starch	70·0
Fat	1·3
Fibre	2·6
Ash	2·1

Barley is, speaking generally, a much more important crop in the cis-Sutlej than in the trans-Sutlej districts. As an unirrigated crop it is often grown mixed with wheat, gram, or *masri*. There is a beardless variety known as *paighambari* or *Kâbuli*. Barley can be sown much later than wheat, in some of the western districts as late as the middle of January, and, except when sown late, it ripens much earlier. Hence it is useful to supply tenants and the poorer landowners with food before wheat becomes available. The grain is also commonly given to horses. Purser quotes a Montgomery proverb—

"Jau kache, pakke, daddare, jo joban turiyán."

"Unripe, ripe, half ripe barley, whatever excellence it possesses is only for horses."

The dry straw or *turi* is an excellent fodder used in the same way as wheat. Being less valuable than wheat a greater proportion of the barley grown is used for green fodder. It is sometimes sown for this purpose with other fodder crops in cotton fields while the cotton is still standing.

The area under barley in rabi 1911 was 1,003,429 acres. In Hissar and Gurgaon it covers a much larger acreage than wheat. The crops with the largest areas were—

	Acres.
Hissar	167,865
Gurgaon	151,086
Ferozepore	149,805

The next largest areas were in Sialkot (59,147) and Kangra (54,986).

Jawi : synonym *jai*.

33. *Avena sativa : natural order, Gramineæ.*—For botanical description see Field and Garden Crops, part I, page 13, and plate III.

Oats have been introduced into the Punjab and are cultivated to a small extent for green fodder.

The wild oats, *gandal* (Avena fatua), sometimes seen in wheat fields, is an introduced weed, which is considered good fodder in California (see Duthie's Fodder Grasses of Northern India, page 51).

CHAPTER III.—Pulses.

Value of mixed crops of cereals and pulses.

34. The value of pulses as food for cattle is enormous, and the extent to which they are grown alone or mixed with cereals, cotton, etc., is a marked feature of the agriculture of the Punjab. The value of the practice of sowing pulses with other crops is great. An excellent statement of the case will be found on pages 141-43 of Moreland's "Agriculture of the United Provinces." Briefly it may be summed up as follows :—

(*a*) *Insurance.*—The pulses generally want less moisture than the crops whose companions they are, and gram, or *mash*, or *múng* may survive when wheat, or cotton, or *jowár* has dried up.

(*b*) Checking of evaporation from the soil, the low growing creeping pulses, shading the surface.

(*c*) Leguminous plants like pulses feed the soil with nitrogen.

(*d*) The produce of mixed crops of wheat and gram or barley and gram are reaped together. The grain is not separated but ground together, and the resulting flour is an excellent food.

Kharif pulses.

35. The kharif pulses with the exception of *gwár* belong to the sub-division Phaseolæ of the natural order Leguminosæ, and the three principal ones, *moth*, *másh* and *múng* are included in the genus Phaseolus, from which the sub-division takes its name. *Gwár* belongs to the same natural order, but to a different sub-division, Jalegeæ.

Gwár, synonym gwára.

36. *Cyamopsis Psoralioides : natural order, Leguminosæ.*—For botanical description see Fuller and Duthie's Field and Garden Crops, part II, page 24, and plate XXXV.

It is an important fodder crop in the districts of the Punjab formerly included in the United Provinces. It is suited to light sandy soil, and is usually sown alone, but is sometimes mixed with *bájra*. It is considered to be a good crop to follow cotton or *chari*, because " the leaves appear to act as manure on the soil and to prepare it for a subsequent rabi " (Hissar Gazetteer, page 170). No doubt, like other leguminous crops, it feeds the soil with nitrogen. The grain is very rich in albuminoids, the chemical composition being —

	Per cent.
Water	11·8
Albuminoids	29·8
Starch	46·2
Oil	1·4
Fibre	7·7
Ash	3·1

But it is considered coarse and produces flatulence, and both grain and leaves and stalks are given to the bullocks. The grain is either boiled or coarsely ground and given dry. The dry straw is useless, but the green plant is cut and chopped up and given to bullocks. The broken pods, called *palosi*, left on the threshing floor, make good fodder.

After gram, *gwár* is the most important pulse in Rohtak, Gurgaon and Delhi. The average in these three districts in 1910-11 was –

Delhi	37,079
Rohtak	59,825
Gurgaon	67,138

Arhar, synonyms dángrí (Gujrat), bhárt (Simla), dhíngra, kúndí (Kangra).

37. *Cajanus Indicus; var. bi-color : natural order Leguminosæ.*—For botanical description see Field and Garden Crops, part II, page 20, and plate XXXIV.

The chemical composition of the unhusked grain is similar to that of gram, but it is difficult to digest—

	Per cent.
Water	13·3
Albuminoids	17·1
Starch	55·7
Fat	2·6
Fibre	7·5
Ash	3·8

In the United Provinces this tall pulse is a very important fodder crop and is usually grown mixed with *jowár*, *bájra*, or cotton. The cultivation and uses

of *arhar* in the United Provinces are described on pages 200-202 of Morland's "Agriculture of the United Provinces." The following may be quoted :—

"When *arhar* is sown with cotton it is usually placed in lines about fifteen feet apart ; it grows thick and high...and it is of particular value as a shelter ; the outturn from a cotton field, is not, however, as great as from a millet field, as the *arhar* plants are far fewer in number ...*Arhar* seems to survive any deficiency of rain short of an absolute drought, and is almost independent of cold weather rain ; while nothing short of regular floods seems to injure it seriously, but it has dangers of its own. The greatest is frost to which the plant is more liable than any other of our field crops : a single ground frost may destroy the entire crop. The caterpillar, known usually as *chheda*, does a good deal of harm in some seasons, boring into the pods and eating the young seeds.....The dry leaves and pods make most nourishing food for cattle and the stalks are put to a great variety of uses, the chief of which is lining temporary wells."

Though sown with cotton, the grain, if it has survived the cold, does not ripen till the beginning of the hot weather. Its great susceptibility to frost makes it unsuited to the climate of most parts of the Punjab, and it is an unimportant crop except in the east of the Gurgaon district, where it is sown in lines with cotton. The leaves are used for fodder, and the stalks for fuel, while "the pulse is little esteemed, so that its perishing in the winter is of the less consequence" (Gurgaon Gazetteer, page 93). The variety which ripens in the autumn and is occasionally sown in Gurgaon seems to be the plant known as *thur* in the United Provinces (Cajanus Indicus, var. flavus).

Másh, synonyms urd, máh, máhri (inferior variety).

38. *Phaseolus mungo; var. radiatus : natural order, Leguminosæ.*—For botanical description see Field and Garden Crops, part I, page 39, and plate X ; also Church's "Food Grains of India," page 148.

Chemical composition of unhusked grains :—

	Per cent.
Water	10·0
Albuminoids	22·7
Starch	55 8
Oil	2·2
Fibre	4·8
Ash	4·4 including 1·1 of phosphoric acid.

This crop and its two relations, *múng* (Phaseolus mungo) and *moth* (Phaseolus aconitifolius) form a group of kharif pulses of great importance as furnishing food for men and cattle. According to Purser there are two varieties of *másh*, one with black seeds known as *burang*, and one with green called *kachúa*. "The former grows as a creeper along the ground ; the latter upright. The pods of *burang* are blackish purple, long and thin ; those of *kachúa* greenish yellow, short and thick.....the dal of *kachúa* is larger, has a better taste, and requires less time in cooking than that of *burang*, hence it sells at 3 or 4 *seers* the rupee dearer" (Settlement Report of Montgomery, page 117).

Másh is sown either alone or mixed with *jowár*, cotton, or with other pulses such as *múng*, *kulath*, or *rawán*. It is unsuited to a light sandy soil in upland tracts, and is therefore not grown with *bájra*. In Jullundur it is mostly found in the best class of dry land and often precedes sugarcane. It is the one of the pulses which is grown most in riverain tracts and in the low hills. In Kangra it is sown on the ridges between rice fields or mixed with *kulath*. It does best in a season of moderate rainfall, and is often destroyed by heavy rain or by floods in the autumn. "The fodder obtained from *moth*, *múng* and *másh* is divided into three kinds, which ranked according to their value, are—the empty pods (*phali*), leaves (*patti*), and the stalks (*gona*). The

last are of little use for cattle and are sold to owners of asses and mules, when possible. The leaves are first stripped off by hand, then the stalks and pods are threshed, next the stalks are picked out, and then the remainder is winnowed and the chaff separated from the grain. As regards their value as fodder, *moth* stands first, *másh* second, and *múng* last (Purser, quoted on pages 186-87 of Jullundur Gazetteer). *Másh* is a good fodder for camels."

Múng, synonym múngli, an inferior variety in Ludhiana.

39. *Phaseolus mungo : natural order, Leguminosæ.*—For botanical description see Fuller and Duthie's Food and Garden Crops, part I, page 37, and plate IX.

To quote from the same book :—

"*Múng* is one of four pulses which resemble one another very closely in appearance and habit of growth, the other three being *urd* or *másh*, *lobia*, and *moth*. *Múng* is the most valuable of the four, and as a rule its consumption is confined to the better class of natives. It can be easily distinguished from either *moth* or *lobia*, but its resemblance to *urd* is so close that both are considered by some botanists varieties of the same species. The most popular distinction between the two plants in the field lies in *múng* having dark green and *urd* yellowish green leaves, but the principal difference is in the shape of the grain in that of *urd* being much larger and longer than that of *múng*. . . . There are three well marked varieties of *múng* having respectively green, yellow, and black seeds. The green seeded is the typical and commonest variety, that with yellow seed, known as *sona* or golden múng, being named *phaseolus aureus*, and that with black seeds *phaseolus max*."

According to Purser the variety with black seeds is called *burang* or *múnga*, and the green and yellow seeded varieties *múngi*.

The chemical composition of the unhusked grain is—

	Green seeded. Per cent.	*Yellow seeded.* Per cent.
Water	10·8	11·4
Albuminoids	22·2	23·8
Starch	54·1	54·8
Oil	2·7	2·0
Fibre	5·8	4·2
Ash	4·4	3·8

It is usually sown with the millets, *jowár* and *bájra*, chiefly the former, with maize or cotton, or mixed with other pulses. It is not suited to the light sandy soil in which *moth* flourishes. It is grown in *sailáb* lands, but not to the same extent as *másh*. *Múng* is the pulse of the Pothwar tract in the Rawalpindi and Jhelum districts. In Rawalpindi it is as a rule sown mixed with *bájra*. Heavy rain in September, when it is in flower, is exceedingly harmful, and both *másh* and *múng* "suffer from the attacks of grasshoppers (*tidda*) when young and later on caterpillars attack the pods and grains" (Steedman, Settlement Report of Jhang, page 93).

The broken straw and stalks are good fodder for cattle, but, as already noticed, not so good as the *bhúsa* of *másh* and *moth*.

Moth, synonym mothi.

40. *Phaseolus aconitifolius : natural order, Leguminosæ.*—For botanical description see Food and Garden Crops, part I, page 41, and plate XI.

The chemical composition of the grain is—

	Per cent.
Water	11·2
Albuminoids	23·8
Starch	56·6
Fat	·6
Fibre	4·2
Ash	3·6 including 0·8 of phosphoric acid.

According to Purser (Montgomery Settlement Report, page 116) there are three, kinds—"*bagga*, *jhijru*, and *garára*. The first grows up straight; the

leaves are not indented ; it throws out no runners ; and the grain is white. The other two kinds throw out runners ; the leaves of *jhijru* are indented ; those of *garára* are not. The grain of *jhijru* is white with black spots ; of *garára* black with white spots." *Jhijru* is evidently the typical phaseolus aconitifolius, which derives its specific name from the fact that its leaves are deeply cut, like those of the aconite plant. *Moth* is a crop of the uplands and is not common in riverain tracts. It grows well in very sandy land, and the most typical association is *bájra* and *moth*, but it is also mixed with *chari*. In Gurgaon a variety called *gora moth* is the pulse usually mixed with cotton, as it spreads and does not climb. *Moth* is also sown alone or mixed with *múng*. In the low hills of the Rawalpindi district it is grown on sloping stony *rakar* soil. Like *másh* and *múng* it suffers from heavy autumnal rains.

The prejudices against the use of *moth* as a food for men which exist in the United Provinces do not appear to extend to the Punjab. In fact in Ferozepore *khichri* or porridge of *moth* and *bájra* is a common dish for the evening meal, and *moth*, *bájra* and *jowár* form in the cold weather the staple foods of the people. But generally its grain is less esteemed than that of *másh* or *múng*, and much more of it is given to live stock and more especially to horses, than is spared from the two other pulses. The main use of *moth* is as a fodder crop, and as that it is held in high esteem. Cut green, when the seed is still unripe (*gharar* in Jullundur) it is an excellent food for horses, and the grain is given to them as a substitute for gram. "Boiled and mixed with crude sugar it is considered unsurpassed for getting horses and bullocks at the end of the cold weather into what natives look upon as good condition" (Purser, quoted on page 160 of Jullundur Gazetteer). In Lahore some is sown early in the hot weather at the same time as the *hárú jowár* and sometimes mixed with it. This is known as *babúl moth* (Lahore Gazetteer, page 163). The *bhúsa* of *moth* is a first class fodder for cattle, the leaves and the broken pods and stalks being all valuable. In Hissar the straw is given to camels, and in Attock they are given green *moth*.

Moth is in the Punjab the most important of the group *másh*, *múng*, and *moth*.

In 1910-11 the areas sown were—

	Acres.
Moth	595,621
Múng	399,882
Másh	259,642

In making the calculation the areas in Rohtak and Gurgaon recorded under the single heading of "*múng* and *másh*" have been divided equally between the two crops.

Kulath, synonyms ranng (Hoshiarpur), Kulthi.

41. *Dolichos biflorus : natural order, Leguminosæ.*—For botanical description see Food and Garden Crops, part III, page 2, and plate LXXXI.

Chemical analysis of unhusked grain—

	Per cent.
Water	11·0
Albuminoids	22·5
Starch	56·0
Oil	1·9
Fibre	5·4
Ash	3·2

This pulse is grown on poor sloping stony soils in the lower hills and up to 6,000 or 7,000 feet. The grain is said to be hard and indigestible. In the Murree Kahuta Assessment Report Mr. Kitchin noted that "though much eaten by the poorest, (it) is eaten by no one who can get any better food." It is stated in Fuller and Duthie's, Food and Garden Crops that "the plant wherever grown is highly valued as a fodder for cattle, and in some parts of the Punjab it is sown in the spring solely for fodder."

In kharif 1910 *kulath* was sown in 618 acres in the Simla and 3,846 acres in the Hoshiarpur district. In Rawalpindi and Kangra it is not shown

separately, but with "other kharif pulses." It probably occupied a very large part of the areas of 26,123 and 3,603 acres returned under that head in Kangra and Rawalpindi respectively.

Rawán, synonyms arwán, lobia, chaula, rangan (Simla).

42. *Vigna catiang : natural order, Leguminosæ.*—For botanical description see Food and Garden Crops, part II, page 12, and plates XXIX and XXX.

The chemical composition of the unhusked grain is—

	Per cent.
Water	12·7
Albuminoids	23·1
Starch	55·3
Oil	1·1
Fibre	4·2
Ash	3 6

This agrees pretty closely with that of másh and múng, but Fuller and Duthie state that the grain is less valued than that of these two pulses, as it is difficult to digest.

It is grown in small quantities in different parts of the Punjab, and more largely in the extreme south-east and in the south-west of the province. In Gurgaon it is known as *chaula*, and is said to be the chief kharif crop on very inferior soils. The area sown there in kharif 1910 was 35,441 acres. The leaves and stalks are used as fodder. In Multan in 1910-11 the area sown was 9,163 acres, of which 7,346 were returned in the rabi crop statement. Mr. Maclagan noted that in Multan it is generally a catch crop after the rabi. In his Settlement Report of Montgomery, page 120, Mr. Purser stated that "*rawán* is grown in the spring only for fodder. It is given to cattle green, mixed with *turi* . . . . Cattle are sometimes turned into *rawán* fields to graze." In the Simla district the grain is eaten as dal or mixed with rice as khichri (porridge), while the straw is fed to cattle.

The handsome wild pea, Vigna vexillata, which is common in the low hills of the Punjab, is a near relation of *rawán*. It is noted on page 420 of volume III of the Dictionary of Economic Products that cattle eat it in Chutia Nagpur.

Rabi pulses.

43. The rabi pulses are divided into—

(*a*) the Vetches belonging to the sub-division Viciæ of the natural order Leguminosæ—

gram, masar, churál, matar,

(*b*) the Clovers or trefoils belonging to the sub-division Trifoliæ of the same natural order—

senji, methra, maina, shaftál, lucerne.

The latter are fodder crops pure and simple, and are fed green to cattle.

Chhola, synonyms chana.

44. *Cicer arietinum : natural order, Leguminosæ.*—For botanical description see Food and Fodder Crops, part I, page 33, and plate VIII.

The chemical composition of the husked grain is—

	Per cent.
Water	11·5
Albuminoids	21·7
Starch	59 0
Oil	4·2
Fibre	1·0
Ash	2·6, including 1·1 of phosphoric acid.

After wheat gram covers by far the largest area of any crop in the Punjab, and is important everywhere except in hilly and submontane districts and in a few districts in the Rawalpindi division to the north of the Salt

Range. In the cis-Sutlej districts it covers an enormous area. The acreage sown in the rabi of 1911 was by divisions—

	Acres.
Delhi	1,960,438
Jullundur	1,203,864, including 710,966 in Ferozepore.
Lahore	617,038
Rawalpindi	354,068
Multan	358,636
Total ...	4,494,044

This was 26 per cent. of the rabi area and 16 per cent. of the area of both harvests.

Gram grows in all kinds of soil from stiff clay to light sand. In sandy soil it has a more feathery habit and the leaves are of a lighter colour than when growing in a clayey soil. The yield of gram is said to be greater when the soil is stiff (Field and Garden Crops, page 34). In medium or light soils it is very often sown mixed with wheat (*gochni*) or barley (*jauchana*, *bejhár*, or *berra*). The discovery that it can be grown with a fair prospect of success in very light sandy soils has led to a considerable extension of rabi cultivation in some of the western districts. The cultivation is very rough, and in heavy soils one sees gram growing among the clods of a field which has been ploughed once and in which no attempt has been made to pulverise the soil or root out the coarse *dab* grass.

A good proverb on the subject is quoted on page 100 of the Ferozepore Gazetteer, edition of 1888-89, page 100—

> "Chhola ki jáne váh,
>
> Máh ki jáne ghá,
>
> Jatt ki jáne ráh,"

which means that gram needs little ploughing, *mash* does without weeding, and a Jat can travel without roads. If the land contains sufficient moisture when it is sown it requires little rain afterwards. But it is a delicate crop in some ways, and when in flower, suffers much from night frosts. Cold westerly winds shrivel up the young grain. It is also said that lightning injures the crop.

We are not concerned with its great use as human food. Of all the pulses it has the least claim to be considered a fodder crop, for its grain is of much more importance as food for horses and cattle than its straw. When bullocks in hard work get a grain ration, gram is usually selected. It is given half-ground and is usually mixed with *bhúsa*. The grain is also given to camels. It is stated in Field and Garden Crops, page 35, that "gram *bhúsa* is considered a most excellent food for cattle, but is seldom given alone, being generally used to give a flavour to more unpalatable fodders." In the Punjab it is much less esteemed as fodder. Hissar and Ferozepore are the districts with the largest gram area according to the crop returns of 1910-11. It is noted on page 174 of the Hissar Gazetteer that "the straw and leaves make an inferior kind of fodder, which is given to camels." In Shahpur gram *bhúsa* is only given to camels except in seasons of scarcity, and is considered bad for horses and milch kine. In Ferozepore it is given to horned cattle, mixed with *turi*, but not to cows or buffaloes when they are in milk. In Attock sheep and goats, and in Jhang cows and horses, are allowed to graze on the young crop, and the outturn is probably little, if at all, injured thereby. In Ferozepore cattle are allowed to graze in irrigated fields of young gram, and the practice is said to improve the ultimate outturn. A wild species of Cicer, C. Soongaricum, grows in Spiti and Lahul. It is said to fatten cattle quickly (Dictionary of Economic Products, volume II, page 284).

45. *Ervum lens or lens esculenta : natural order, Leguminosae.*—For botanical description see Field and Garden Crops, part II, page 13, and plate XXXI.

Masri, synonyms masar, mohr, mohri.

Chemical composition of unhusked grain—

	Per cent.
Water	11·7
Albuminoids	24·9
Starch	56·0
Oil	1·5
Fibre	3·6
Ash	2·3, including 0·7 of phosphoric acid.

Husked the fibre is reduced to 1·2 per cent. and the starch increased to 58·4 per cent. As regards its value as human food Professor Church writes—

"It is highly nutritious, but somewhat heating; it should be carefully freed from the husk or coat. The meal of lentils deprived of their coat is of great richness, containing generally more albuminoid or flesh-forming matter than bean or pea-flour. The preparations advertised under the names of 'Revalenta,' 'Ervalenta,' etc., consist mainly of lentil meal mixed with flour of barley or some other cereal and common salt" (Food Grains of India, page 139.)"

We are told that the mass of pottage, for which Esau sold his birthright, was probably composed of *masri* flour (Dictionary of Economic Products, volume IV, page 621). *Masri* alone or mixed with barley is sown in poor damp riverain lands or after rice in flooded lands. Its grain is used as *dal* for human food and the dry stalks and leaves as fodder. It is not regarded as a valuable fodder. Mr. Purser noted that some considered it heating and bad for milch kine, while others thought it good for all cattle, as being sweet (Montgomery Settlement Report, page 122).

The area recorded in the district revenue registers in 1910-11 as sown under the heads of *masri* and *jaumasri* was 225,787 acres.

46. *Lathyrus sativus : natural order, Leguminosæ.*—For botanical description see Field and Garden Crops, part II, page 15, and plate XXXII.

Churál.

Chemical composition of pea—

	Per cent.
Water	10·1
Albuminoids	31·9
Starch and fibre	53·9
Oil	·9
Ash	3·2

called in the United Provinces *kesari.*

This humble pulse is grown in damp riverain lands and is used almost wholly for fodder, especially for cows and female buffaloes. The *dal* has a bad reputation for human food, and indulgence in it is undoubtedly sometimes followed by paralysis of the lower limbs. The curious statement in the late Mr. O'Brien's Settlement Report of Muzaffargarh that "to sleep in a pea field is believed to produce a kind of paralysis called *munda,*" probably refers to *churál.* Mr. Purser in the Settlement Report of Montgomery, page 122, writes :—"This crop is grown chiefly for green fodder. The plants are pulled up or cut. The dry stalk and leaves are considered good fodder for cattle, but not for horses," as causing constipation. Mr. Maclagan on page 220 of the Multan Gazetteer puts the average selling value of *churál* at Rs. 10 per acre.

47. *Pisum arvense: natural order, Leguminosæ.*—For botanical description see Field and Garden Crops, page 17, and plate XXXII B.

Matar.

Like *churál* this pulse is mostly grown in moist river lands and used for fodder. The peas have no poisonous qualities, and on page 90 of the Jhang Settlement Report the late Mr. Steedman noted that the pods were picked green and eaten as a vegetable, and that the grain was not usually threshed except for seed.

In the south-western districts peas (*churál* and matar, which are not distinguished in the crop returns) are important fodder crops. The area in Multan in rabi 1911 was 40,856 acres.

The area recorded under *churál* and matar or peas in the district revenue registers was 148,971 acres. Few districts outside the Multan division sow any large acreage.

48. *Melilotus parviflora : natural order, Leguminosæ.*—For botanical description see Hooker, Flora of British India, volume II, page 89. It has minute yellow flowers growing in a raceme (see illustration I). It does not appear to be cultivated to any extent in the United Provinces, for it is not mentioned in Fuller and Duthie's Field and Garden Crops, but in the Punjab it is an important fodder crop. It is often grown in irrigated land after cotton or maize, being sown between the lines while these crops are still standing. Farmers sow it to supply green fodder to their own cattle and do not as a rule sell it, except near cities like Lahore and Amritsar, where it fetches a good price.

Senji.

Its relation melilotus alba is a Punjab wild plant, which cattle doubtless eat.

49. *Trigonella fœnum-græcum : natural order, Leguminosæ* —For botanical description see Field and Garden Crops, part III, page 46, and plate XCIX, also Hooker Flora of British India, volume II, page 87. It has some resemblance to senji, but is distinguished by its humbler growth and larger light yellow flowers. It is fairly common in damp riverain lands, but is also grown on irrigated lands, where it is often sown between the lines of cotton. It is used as green fodder, and can be cut several times if the plant is watered after each cutting.

Methra, synonyms metha, methi, methun.

50. *Medicago denticulata* (see illustration I).—Is a common Punjab wild plant, which no doubt is eaten by cattle, though it is not included in the list of fodder plants in the Dictionary of Economic Products. It springs up thickly in Gujranwala in cotton fields, and is watered, so may there be considered a fodder crop. A very considerable part of the area of 624,020 acres shown under rabi fodder in statement II was no doubt under *senji* and *methra.*

Maina.

51. *Medicago sativa : natural order, Leguminosæ.*—It is perhaps a cultivated variety of medicago falcata which grows wild in Kashmir and Kunawar (see Hooker, Flora of British India, volume II, page 90). The flowers are usually purple. The plant has been introduced as a crop from Europe, and is commonly grown at remount depôts, to supply green fodder for horses. It covers a large area at the Mona Remount Depôt in the Gujrat district. It belongs to the same group as methra, senji, maina and shaftál (see also Fuller and Duthie's Food and Garden Crops, part III, page 61). The medicagos are distinguished by their curious spirally twisted pods. There are three wild species besides M. denticulata mentioned above in the plains—M. lupulina, M. lociniata, M. minima—no doubt all useful to cattle though not included in the list of fodder plants in the Dictionary of Economic Products.

Lucerne.

52. *Trifolium repens : natural order, Leguminosæ.*—It is cultivated in Afghanistan, Hazara, Peshawar, and Bannu, and in the Attock tahsil of the Attock district. In Bannu it is, like senji and methra, usually sown in maize

Shaftál.

1. Maina = Medicago denticula
2. Senji = Melilotus parviflora
3. Methra = Trigonella fænum græcum.

and cotton fields. It belongs to the same group as methra, senji, and lucerne, and it might be worth while to try to extend its cultivation in the Punjab. Trifolium pratense (red), Trifolium repens (white), and Trifolium fragiferum (straw-berry headed trefoil) are English clovers, which also grow wild in the hills.

The ground-nut or múngphali.

53. A foreign leguminous plant, Arachis hypogæa or the ground-nut (see figure 22 in Church's "Food Grains of India") is now much cultivated in Southern India. It has the curious property of burying its pods in the ground. "The seeds are a valuable source of oil, and are also eaten. The leaves and branches of the plant are.....an excellent fodder. The hay is very nutritious, much increasing the milk of cows. The cake holds a high reputation as a food upon which cattle rapidly fatten." (Dictionary of Economic Products, volume I, page 287). Probably the Punjab climate is too cold for the ground-nut.

Bhut.

54. *Glycine hispida : natural order, Leguminosæ.*—For botanical description see Field and Garden Crops, part III, page 3, and plate LXXXV.

This is the soy bean of China and Japan of which the seed is now largely exported to England for oil. In the United Provinces it is cultivated under the name of *bhat* in the lower hills and in a few of the neighbouring plain districts. "The plant affords excellent fodder for all kinds of stock, if harvested before it is fully matured." The extent to which it is now cultivated in the Punjab hills requires investigation. It appears from page 243 of Punjab Products that several samples of a plant called *bhut*, which was identified as soja or glycine hispida, were sent to the Lahore Exhibition of 1864 from the Hill States. This was probably an inferior variety of the Chinese plant. The desirability of introducing into the hills and submontane districts a good kind of soy bean may be judged from the following extracts from the Dictionary of Economic Products, volume III, page 111 :—

"The chemical composition of the bean, according to Professor Kinch, places it above all other pulses as an albuminous food, while that of the straw also surpasses in nitrogenous value that of wheat, lentils, and even hay. The following composition is given by Professor Church :—In 100 parts of the bean water 11, albuminoids 35·3, starch and sugar 26, fat 18·9, fibre 4·2, ash 4 6.....The soy bean is an extremely valuable fodder plant. If cut just when the pods are, fully formed, it makes most nutritious hay, and the residual cake (after oil has been expressed from the seed), which contains, according to Church, 40 per cent. of flesh-forming materials and 7 per cent. of oil, is an extremely rich cattle food."

CHAPTER IV.—Oilseeds, Turnips and Carrots.

Crops included in chapter.

55. We now come to a group of plants of great importance in the feeding of cattle because the roots and the green leaves and stalks are eaten, and the refuse made after oil has been expressed from the seeds is the chief source of oil-cake. These plants belong to the order Cruciferæ, and three-fourths of them, sarson, toria and turnips, are varieties of Brassica campestris. Taramira belongs to the nearly related genus Eruca. Although carrots belong to a different natural order, it is convenient to include them in this section, as their use as fodder is similar to that made of turnips.

Sarson, synonyms saron, sirsam, sarshaf, malwáni.

56. *Brassica campestris ; sub-species napus, varieties glauca, trilocularis, quadrivalvis, and dichotoma.*—For botanical descriptions see pages 28-30 of Field and Garden Crops and plates XXXVII to XL.

Natives recognise two varieties, black and yellow. The former, which is Brassica campestris, variety dichotoma, is said to be more hardy, but less rich in oil.

Sarson is sown either alone, or mixed with wheat, barley, gram, or other crops. When mixed it is sown either scattered or in lines (*ad*). It is one of the crops sown for fodder in cotton fields, while the cotton is still standing. Except in the south-western districts, where it is unimportant, it is rarely irrigated. It is noted on page 168 of the Lahore Gazetteer, edition of 1893-94, that on well lands it "is seldom sown except with wheat, when the two are intended to be cut together for fodder." It is a delicate plant, very liable to injury from frost. It ripens the earliest of the rabi crops except *toria*.

The seed yields a bitter oil (karwa tel), which is good for burning and also for cooking, though for this purpose not equal to *til*. The refuse, after the oil has been expressed, is a valuable oil-cake, but much of the seed is exported to Europe. The young flowering shoot is used for *ság*. *Sarson*, when sown as a mixed crop, is pulled up and fed green to cattle in January and February. It is noted on page 123 of Purser's Montgomery Settlement Report that when well irrigated and manured two cuttings for fodder can be got, if the first is taken before, or very early in Magh. The dried threshed straw is of no use.

The area under *sarson* in 1910-11 was 350,000 acres, but it is extremely difficult to record the area of this crop accurately, and in one or two districts it is lumped with *táramíra* or *toria*. The districts with the largest areas in rabi 1910 were—

	Acres.
Ferozepore	80,641
Karnal	47,698

It is a favourite crop in Gurgaon, Karnal and Ludhiana. In the Rawalpindi and Multan divisions *táramíra* is much more important than *sarson*.

Toria, synonyms sathri, tirpakhi.

57. *Brassica campestris; sub-species napus, variety toria : natural order Cruciferæ.*—For botanical description see pages 29-30 of Field and Garden Crops and plate XLA.

In Sialkot *toria* is a crop of some importance, and it was probably introduced into the Lower Chenab and Lower Jhelum Canal Colonies by immigrants from that district. It has become a very popular canal-irrigated crop in both colonies, on the Upper Bari Doab Canal in Lahore and on the Sidhnai Canal in Multan.

The following passage from the Gazetteer of the Lower Chenab Colony may be quoted :—

"The popularity of *toria* with the colonists is easily explicable. It is in the ground for only some 3½ months, requires but little water, and that mainly at a time when wheat sowings have not commenced. Once sown it makes no demands on the energies of the colonists . . . . There is a uniformly steady demand in the market for the seed, which is exported mainly to Italy and Marseilles, to be manufactured into 'finest Lucca oil'. . . . It is curious that the zamindar will not eat the oil, which he uses himself only as an illuminant. It is popularly considered to be heating. A little *toria* is grown by the Janglis as green fodder for cattle and by Biloches for their camels . . . . The pressed seed is given to buffaloes to increase lactation."

In Sialkot *toria* is generally an irrigated crop, but in Karnal it is mostly grown without irrigation. The *chahi* area, however, expands in a year of drought when the people want a crop which ripens quickly. The name sathri, by which it is known in some western districts, is an allusion to the fact that it is supposed to ripen (or perhaps to be of use for fodder) in sixty days. It is a delicate crop, but ripens so early that it stands a good chance of escaping damage from frost. It is mainly grown for the export of the seed, which fetches a good price. The oil-cake is not liked by cattle as it has a bitter taste. As fodder *toria* is much less appreciated than *sarson*, as the leaves are said to be bitter. But on page 221 of the Multan Gazetteer, edition of 1901-02, Mr. Maclagan noted that in that district outside the Sidhnai area "it is mainly grown along with turnips, and forms, when so grown, a green fodder, which is available for the cattle earlier than the turnips."

Owing to its popularity in the new canal colonies *toria* now covers a larger area than sarson. The area given in statement II is 440,701 acres.

In rabi 1910-11 the area sown with toria was returned as 192,140 acres in Lyallpur, 81,472 acres in Shahpur, 59,224 acres in Lahore, and 24,378 acres in Amritsar.

The area for the whole province was probably about 400,000 acres.

Other sources of oil-cake.

58. It may be as well to note here the other sources of oil-cake.

The chief is *til* (*Sesamum indicum : natural order, Pedalineæ*), which is specially valued for use in the cold weather.

Alsi (*Linum usitatissimum : natural order, Linaceæ*) is another source.

Gonglu, synonyms shalgam, ság, gandraf.

59. *Brassica campestris ; sub-species napus.*—The chemical composition of the root is—

	Per cent.
Water	90·4
Albuminoids	1·0
Fatty and heating matters	7·9
Inorganic matters	0·7

The importance of turnips as food for cattle in the districts of the Multan division is very great. They are also largely grown in Shahpur, Lahore, Gujranwala, Mianwali, and Gujrat. On page 222 of the Multan Gazetteer Mr. Maclagan wrote :—

"The Multan district grows more turnips than any district in the Punjab. This crop represents 6·3 per cent. of the cultivation, and its function is to keep the cattle alive when the *jowár* fodder is finished, until the wheat and wheat straw are available. It is used to a small extent as food, the stalks (*gandal*) being cooked and the roots being eaten either raw or cooked, but it is not cultivated with this object. There are two varieties, the red and the white, of which the white are said to be the better and the more widely cultivated. The crop needs a fair amount of water and is rarely found outside the reach of well irrigation.....The ploughings begin in July and the seed is sown shortly after. The crop receives six or seven waterings during the autumn and winter ; it is manured if possible, and sometimes weeded. The roots are not taken up at one time and stacked, but are pulled from time to time from the end of November onwards, and given at once to the cattle. As a rule the tops and roots are given together, but sometimes the tops are cut and fed off separately, while the roots remain in the ground. The plants are never thinned or transplanted. The crop is sometimes grown along with other crops such as *methra*, gram, *sathri* and *ussun*."

With this may be compared the late Mr. Steedman's account of the crop on page 89 of his Settlement Report of Jhang :—

"Turnips are on well lands a most important crop in this district. The well oxen are very heavily worked during the wheat sowings and the first waterings, and require a large amount of strengthening food. This is furnished by the *jowár* and turnip crops. There is nothing else. If the turnips fail, or are late as they often are, owing to the failure of the first sowings, the working power of the bullocks is materially weakened, and the area under wheat does not get properly watered. Turnips, raw and cooked, are also eaten largely by the tenants during the cold weather. To them, no less than to the bullocks, a bad turnip crop is a serious misfortune. * * * * *

"The best land on the well, well ploughed and liberally manured, is allotted to this crop. The land will generally have been ploughed up after rain once before the seed time arrives. The land is then irrigated and ploughed from three to six times with one or two rollings in between, if there are any clods to be broken up. The seed is sown broadcast, mixed with sand or earth or manure. Then the soil is once more rolled, and the irrigation beds and channels are made. If the soil has now become somewhat dry, a watering is given at once, but usually the first watering is given a few days after the plants have come up. When turnips are sown on well lands in soil that has been ploughed up once or twice previously a couple of ploughings are given, and then the well beds and irrigation channels are banked up. * * * * * * *

"For *sailab* lands the process is different. The land is ploughed twice or three times and rolled. The seed is sown broadcast and ploughed in with very shallow furrows. * * *

"The crop ripens in three months. *Zamindars* say turnips are not ready till the first frosts. It is watered five or six times. No weedings or hoeings are given. A turnip crop should not be too thick, or it runs to leaf, and the bulbs suffer. A first class crop is that which yields a good fodder crop of leaves first, and a heavy root crop afterwards.

"The turnip leaves are cut once, sometimes twice on the very best lands, and then the bulbs are pulled up. On *sailab* land the leaves are not cut, but the whole plant is pulled up. The bulbs grow very large on *sailab* lands. I have also seen them eaten on the ground, but this is of course very different from what is meant by the process at home. The great difficulty about the turnip crop is to sow the seeds early and yet to get it to germinate well."

In crop returns turnips and carrots are clubbed together, but in districts where turnips are important carrots form an insignificant part of the total. In rabi 1911, the districts returning the largest acreage were—

Multan	59,426
Montgomery	43,210
Shahpur	41,707
Gujranwala	23,698
Muzaffargarh	22,791
Lahore	14,990
Gujrat	10,584

The total acreage given in statement II is 280,652 acres.

Ahur, synonyms arhu, arhion.

60. *Brassica juncea : natural order, Cruciferæ.*—For botanical description of the mustard plant see Field and Fodder Crops, page 33, and plate XLI.

Mustard is not much grown in the Punjab. It is stated on page 34 of the Field and Garden Crops that in the United Provinces "it is not uncommonly cut green in January and February and given to cattle, should the supply of cattle fodder have run short."

Táramíra, synonyms tira ussun (S.-W districts), jamián and jandh (N.-W. districts).

61. *Eruca sativa : natural order, Cruciferæ.*—For botanical description see Field and Garden Crops, page 26, and plate XXXVI.

Táramíra is the oil-seed par excellence of the districts of the Rawalpindi division lying to the north of the Salt Range and of Mianwali. It is there an unirrigated crop. The description given in the Attock Gazetteer (page 152), which would also apply to Jhelum, Gujrat, Rawalpindi and Mianwali, may be quoted :—

"*Táramíra* is one of the three important rabi crops, and in Fattehjang and the Attock Nala ranks after wheat alone. It needs no cultivation, the seed is cheap, and the crop will grow on any land. It is grown almost exclusively on the most inferior kinds of unirrigated land, much of the poorest *rakar* being able to produce nothing more than a light *táramíra* crop, unless it be a very poor cotton. *Táramíra* is sown along the edges of paths, over the ridges between fields, is dribbled in among the *bájra*, and is scattered broadcast about the fields whenever rain falls in November. The seed is cheap, and the *zamindar* who cannot afford wheat seed can always afford *táramíra*. If the crop fails there is little loss, and if it succeeds the profit is large. It is a most useful crop. Like gram it is used as a vegetable when green. A good deal is also consumed for fodder. It is the favourite food of camels. But the bulk of the crop is allowed to ripen, and a valuable oil extracted. The only objection to *táramíra* is that it is an exhausting crop, and is considered the most exhausting of all rabi crops. In a good year the *táramíra* pays the revenue of the whole year, and great quantities are exported. In Fattehjang itself there are a great many oil-presses, and the oil stored in kerosine tins is sent into Rawalpindi and Gujar Khan for export. The oil for lighting purposes has now been superseded by kerosine, but it is considered very strengthening and healthy as an article of food, and in many ways takes the place of *ghi* for frying, &c. The outward application in plague and other cases is said to be very beneficial. The Kot estate makes a large income annually from this crop. A remarkable characteristic of *táramíra* is its vitality. It is often self-sown. In years of good rainfall it springs up everywhere, even on the house tops, in the Kala Chitta Forest, and among the ballast on the

railway lines. The real matured area can never be determined, and the recorded area can be considered only a very rough estimate. Taken all in all *táramíra* is probably a more important crop than even gram."

In Rawalpindi besides being cooked as a potherb it is the favourite food for cattle.

In Multan, Muzaffargarh, and Dera Ghazi Khan, where it is known as *ussun*, it is often an irrigated crop. On page 221 of the Multan Gazetteer Mr. Maclagan wrote :—

"*Ussun* does not require much moisture; it is grown on pure canal or *baráni* cultivation. It is often found on the outer reaches of well estates where it will get water if there is any to spare, but will survive well enough if there is none. It is also often grown with turnips."

In Muzaffargarh it is sown as fodder with peas or gram, and there "in very hot weather ussun is mixed with bruised barley, and wetted and given as a cooling food to buffaloes."

The districts which returned the largest areas as sown in rabi 1910 were :—

	Acres.
Dera Ghazi Khan	81,806
Ferozepore	21,906
Attock	19,347
Multan	14,276
Mianwali	13,044
Jhelum	13,699
Ámbala	12,697
Muzaffargarh	11,346
Gurgaon	10,154

The figures for Dera Ghazi Khan include sarson and toria, but the deduction to be made on that account is probably not large.

The handsome violet flowered chanáka (*Diplotaxis griffithii*), which grows freely near the Salt Range, is worth experimenting with as a possible source of oil and fodder, especially as the seed has some small commercial value as a drug (Attock Gazetteer, page 19).

Gájar (carrots).

62. *Daucus carota : natural order, Umbelliferiæ.*—For botanical description see Hooker's Flora of British India, volume II, page 718, and illustration LXXVIII in Field and Garden Crops. A curious feature of the plant is that the central flower in the umbel is often red. In the Punjab it is an irrigated crop, and generally grown in small patches on wells. The tops are fed green to cattle in January and February. The roots, besides being a useful food for men, are given to horses.

CHAPTER V.—Other Crops.

Vanwár cotton, synonyms kapáh, kapás, bári (eastern districts), vár, váran.

63. *Gossypium neglectum : natural order, Malvaceæ.*—For botanical descriptions see Field and Garden Crops, part I, page 75, and plate XVIII.

The cotton seed (*binola, varemva, pewe*), which contains much oil, is a very valuable food for milch kine. In Karnal after the cotton is picked the cattle are turned into the field to eat the leaves (Karnal Gazetteer, edition of 1890, page 200).

Kamád, synonym ikh (eastern districts).

64. *Saccharum officinarum : natural order, Gramineæ.*—For botanical description see Field and Garden Crops, part I, page 55, and plate XIV.

When cane is reaped the arrow or top (*ág or pánd*) is cut off and used as fodder. A bad feature of a fodder famine is the extent to which cane has to be sacrificed to keep the cattle alive. In Gujranwala, even in a normal year, a great deal of the cane goes to feed the bullocks.

65. *Crotalaria juncea : natural order, Leguminosæ.*—For botanical description see Field and Garden Crops, part I, page 82, and plate LXXXII.

Sani, synonym san.

This leguminous plant, which is grown in small patches for its fibre, should be carefully distinguished from sankukra (also called san and sinjubára), which is *Hibiscus cannabinus*, natural order *Malvaceæ*, also grown for fibre, which is planted as a hedge round cotton and cane fields. It is stated in "Field and Garden Crops" that in the United Provinces the tops of sani are cut off and given to cattle when the plants are in full flower, and Mr. Duthie notes in his Flora of the Indo-Gangetic Plain, page 206, that the green plant as well as the seeds are sometimes given as food to milch cows.

There are several species of Crotalaria which occur as wild plants in the Punjab. The only two included in the list of fodder plants in the Dictionary of Economic Products are Medicaginea and C. linifolia, but C. burhia is valued for fodder in Rajputana (Flora of Indo-Gangetic Plain, page 202), and it is unlikely that cattle neglect the others.

66. *Lepidium sativum : natural order, Cruciferæ.*—For botanical description see Hooker's Flora of British India, volume I, page 159, and illustration II appended.

Halon.

It is a very unimportant rabi crop. A few scattered plants are sometimes seen mixed with other crops. The seeds contain a good deal of oil. Its use as fodder is not referred to in the "Field and Garden Crops of the United Provinces" (part III, page 49), but Purser on page 185 of the Jullundur Gazetteer mentions it as one of the spring fodder crops. It was apparently introduced into India from the West, but its relation, Lepidium draba, is a weed of cultivation in the Punjab and is one of the English wild flowers. No doubt it is one of the plants weeded out of the fields, which finds its way into the cattle trough, for it is greatly valued as green fodder at Quetta, where it is a common weed (Dictionary of Economic Products, volume III, page 415, and volume IV, page 626).

67. *Cichorium intybus : natural order, Compositæ.*—For botanical description see Hooker's Flora of British India, volume III, page 391, and plate LXXIV in Fuller and Duthie's "Food and Garden Crops."

Kásni.

Chickory is an English wild plant and also grows wild in the North-Western Himalaya. It is found apparently wild in the Punjab plains, but is there perhaps originally an escape from cultivation.

It is grown alone or mixed with *sarson* as a fodder crop on wells in Gurgaon and the Jhajjar tahsils of Rohtak.

68. *Carthamus tinctorius : natural order, Compositæ.*—For botanical description see Fuller and Duthie's Food and Garden Crops, part I, page 51, and plate XIII.

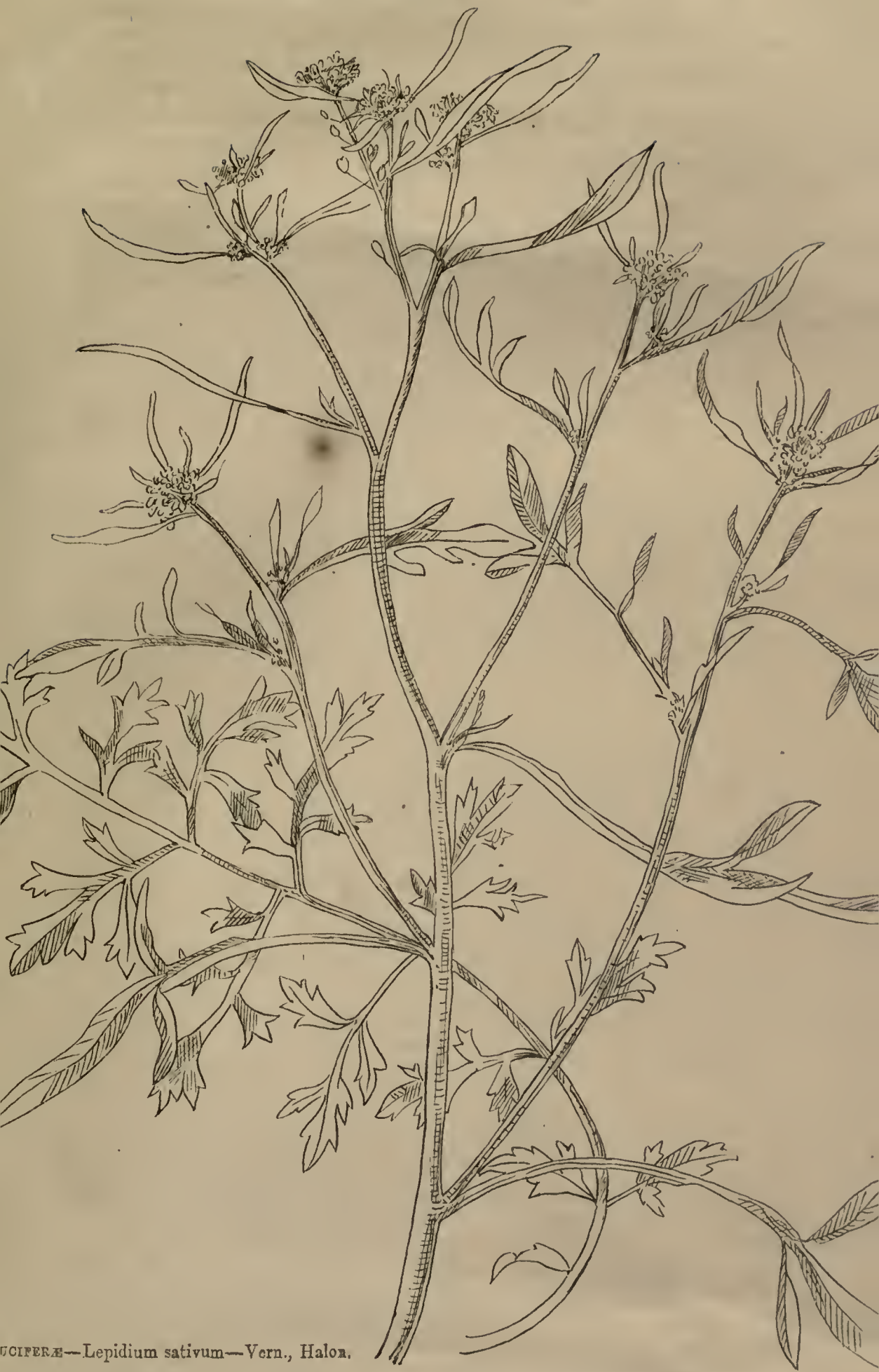
Kusumbh, synonym kharar.

In the last twenty years the cultivation of safflower for the sake of the dye yielded by the flowers has been killed by the introduction of aniline dyes. About 1885 the area under safflower in the Hoshiarpur district exceeded 6,000 acres; in rabi 1911 47 acres were sown. The area in Ambala was nearly 5,000 acres in 1887-88.

In Gujrat and Jhelum safflower is sown in lines in wheat fields like *sarson*, and the plants are pulled out and fed to the cattle in January and February.

The ripe seed used to be valued in the United Provinces for its oil, which was used to adulterate *ghi*, and the refuse made an excellent oil-cake (Field and Garden Crops, page 51). But in Gujrat only enough is allowed to ripen to provide for the next sowings.

ILLUSTRATION II.



UCIFERÆ—Lepidium sativum—Vern., Halon.

Pohli (*Carthamum oxyacantha*), a thorny weed with yellow flowers, a near relation of safflower, is common in the Punjab, and in the north-west of the province poor people in times of scarcity use the seeds as food. They also contain oil.

Hindwána (melons), synonym titak (smaller).

69. In the sand hills of the Thal of Mianwali, Muzaffargarh and Jhang melons are a catch crop. The rinds are fed to cattle. Pandit Hari Kishan Kaul has given me a note on the subject :—

"The melon is split up, the seeds separated and the pulp eaten by men, the shell being given to the cattle. Where melons grow in great abundance, the pulp and the shell are both thrown to the cattle, only the choicest melons being reserved for men. The seeds are dried, parched, and eaten like parched gram, or in years of scarcity pounded into flour and eaten in the form of cakes. Camels are not fed on melons, partly because they are considered injurious for camels and horses, and partly because camels have plenty of other fodder. They are, however, allowed to eat the creeper, and, when grazing in melon fields, do not mind picking up as many small melons as they can."

Nil (indigo).

70. *Indigofera tinctoria : natural order, Leguminosæ.*—For botanical description see Fuller and Duthie's Field and Garden Crops, part I, page 43, and plate XII.

The cultivation of indigo for the dye and the supply of seed to the Behar planters was once important in the eastern districts, but the area under the crop there is now quite insignificant. It is noted in the Rohtak Gazetteer (page 104) that "latterly it is said to have been tested as a fodder crop." Several of the wild Indigoferas are in the list of fodder plants in volume III of the Dictionary of Economic Products, but it does not include the "káthí" or Indigofera gerardiana so common in the low hills. Indigo is still cultivated to a considerable extent in Multan, Muzaffargarh and Dera Ghazi Khan for the sake of the dye which is exported to Afghanistan, Bokhara and Yarkand (Multan Gazetteer, page 215).

Acknowledgments.

71. Acknowledgments are due to the officers named in this note and to Mr. Lall, Settlement Officer of Gujranwala, and to M. Sant Singh, President of the Kalsia Council, for their ready response to requests for information. Mr. Dunnett has kindly agreed to correct the proofs in my absence.

J. M. DOUIE.

26th January 1912.

STATEMENTS.

STATEMENT I.—Areas, wells, ploughs,

	District.	Cultivated acres.				Grazing land.			Masonry wells in use.	Ploughs.
		Chahi and abi.	Nahri.	Unirrigated.	Total.	Government forests.	Other.	Total.		
	2	3	4	5	6	7	8	9	10	11
						Acres.	Acres.	Acres.		
1	Hissar	3,806	302,121	2,385,551	2,691,478	2,033	437,551	439,584	720	89,401
2	Rohtak	46,107	289,694	638,399	974,200	2,876	138,844	141,720	2,459	50,870
3	Gurgaon	141,448	97,235	749,930	988,613	...	90,560	90,560	6,594	57,304
4	Delhi	105,885	98,419	350,753	555,057	1,488	122,002	123,490	7,133	38,661
5	Karnal	150,817	241,921	756,138	1,148,876	9,041	575,803	584,844	7,827	73,974
6	Ambala	43,757	3,146	714,819	761,722	874	104,590	105,464	2,154	66,726
7	Simla	736	...	9,171	9,907	...	21,625	21,625	...	2,790
8	Kangra	117,155	...	470,144	587,299	616,197	263,614	879,811	5	126,218
9	Hoshiarpur ...	41,708	17,843	680,748	740,299	2,082	176,489	178,571	6,841	92,457
10	Jullundur ...	307,722	...	387,849	695,571	478	87,997	88,475	28,287	79,121
11	Ludhiana	140,866	51,896	561,611	754,373	61	65,503	65,564	9,991	50,897
12	Ferozepore ...	157,126	909,345	1,181,851	2,248,322	733	199,828	200,561	7,949	112,306
13	Lahore	469,656	636,118	356,334	1,462,108	8,452	449,966	458,418	13,828	109,251
14	Amritsar	248,210	242,282	296,737	787,229	1,318	86,395	87,713	12,386	69,304
15	Gurdaspur ...	142,253	88,500	613,650	844,403	714	95,924	96,638	6,439	86,238
16	Sialkot	530,845	9,869	400,844	941,558	3,934	165,649	169,583	23,010	104,072
17	Gujranwala ...	438,829	477,050	263,469	1,179,348	47,831	533,801	581,632	10,926	88,960
18	Gujrat	218,614	...	626,409	845,023	2,486	154,926	157,412	10,221	80,248
19	Shahpur	178,699	696,103	392,754	1,267,556	160,357	1,049,747	1,210,104	6,403	84,825
20	Jhelum	27,169	179	727,237	754,585	13,650	100,578	114,228	4,103	63,733
21	Rawalpindi ...	5,046	1,860	591,465	598,371	168,502	311,402	479,904	947	65,636
22	Attock	28,068	7,697	996,197	1,031,962	12,085	248,970	261,055	6,850	68,060
23	Mianwali	124,828	17,597	605,830	748,255	804,310	2,729,042	3,533,352	7,128	47,262
24	Montgomery ...	231,781	224,596	358,978	815,355	1,116,301	446,436	1,562,737	10,472	73,193
25	Lyallpur	4,813	1,359,611	9,468	1,373,892	369,831	99,618	469,449	84	91,170
26	Jhang	262,532	333,391	127,810	723,733	445,916	751,158	1,197,074	11,588	61,468
27	Multan	641,315	279,842	159,873	1,081,030	986,518	902,249	1,888,767	20,132	97,921
28	Muzaffargarh ...	223,433	181,757	148,453	553,643	247,285	876,356	1,123,641	14,053	79,169
29	Dera Ghazi Khan ...	288,273	165,898	580,840	1,035,011	120,839	1,387,069	1,507,908	9,564	57,850
	Total ...	5,320,447	6,733,970	16,144,362	28,198,779	5,146,192	12,677,320	17,823,512	248,122	2,169,085

CATTLE, CARTS, AND POPULATION.

Horned cattle.									
Bulls and bullocks	Male buffaloes.	Cows.	Female buffaloes.	Young stock.	Total of columns 12 to 16.	Horses and ponies.	Camels.	Carts.	Population.
12	13	14	15	16	17	18	19	20	21
115,161	7,375	132,988	85,550	197,577	538,651	7,855	43,686	11,659	804,889
95,119	960	82,113	57,093	140,851	376,136	3,757	2,419	16,676	841,489
113,279	1,921	98,714	65,442	134,069	413,425	7,738	1,924	12,693	643,147
86,307	1,237	60,555	53,385	92,947	294,431	5,031	649	14,447	657,604
189,536	4,521	149,159	151,768	211,870	706,854	10,388	1,650	18,180	799,787
174,684	2,348	111,460	90,459	144,952	523,903	10,487	617	23,941	689,970
6,865	64	8,109	1,311	5,707	22,056	302	...	4	39,320
296,015	17,377	238,967	101,161	214,833	868,353	8,171	189	130	770,386
201,800	28,625	134,156	91,630	153,589	609,800	10,683	1,724	20,925	918,569
160,141	30,402	77,219	64,016	114,634	466,412	8,804	840	28,405	801,920
120,981	2,482	59,929	62,263	101,228	346,883	5,078	2,409	20,796	517,192
230,377	22,659	109,749	137,979	188,277	689,041	19,371	27,123	31,411	959,657
185,701	62,607	121,894	144,286	176,836	691,324	27,607	3,914	16,514	1,036,158
115,899	47,405	79,880	114,006	119,026	476,216	16,449	603	8,402	880,728
156,597	70,628	163,604	76,742	158,600	626,171	15,749	884	8,760	836,771
129,013	61,529	120,635	127,332	128,398	566,907	15,406	158	3,754	979,553
125,897	69,273	110,916	132,486	149,574	588,146	18,359	2,178	5,713	923,419
134,790	33,269	93,593	90,382	124,000	476,034	13,506	2,545	616	745,634
170,853	29,636	168,573	93,292	166,087	628,441	27,032	16,360	3,871	687,366
98,140	4,946	102,666	26,957	86,723	319,437	6,819	5,498	495	511,575
93,465	2,305	99,715	31,789	81,989	309,263	11,971	3,711	6,285	547,827
95,088	3,751	123,657	19,272	82,661	324,429	5,755	8,699	1,467	519,273
100,531	1,346	80,806	16,067	53,744	252,494	4,938	21,682	60	341,377
139,049	43,373	127,627	63,139	102,587	475,775	14,722	16,468	763	857,711
198,525	37,848	132,759	143,138	213,030	725,300	26,490	11,135	29,256	535,299
131,541	22,167	124,725	73,339	121,971	473,743	14,396	12,699	340	515,526
232,260	9,661	182,696	57,154	146,660	627,831	13,804	23,165	1,486	814,871
184,952	3,830	149,012	40,993	111,113	417,900	10,818	33,445	87	569,461
144,928	1,420	137,769	28,940	97,037	410,094	16,708	24,148	529	499,860
4,247,494	624,965	3,383,645	2,241,371	3,819,975	14,317,450	358,244	270,522	287,688	19,946,369

STATEMENT II.—ACRES SOWN IN

DISTRICT.	Maize.	Jowár.	Chari.	Bájra.	Kangni and china.	Rice.
1	2	3	4	5	6	7
Hissar	1,002	156,170	104,532	638,089	...	7,734
Rohtak	348	162,509	17,410	247,389	...	110
Gurgaon	2,340	53,284	42,814	288,107	20	114
Delhi	10,644	58,778	28,079	82,774	50	217
Karnal	60,091	137,241	54,591	57,430	7,231	47,153
Ambala	96,283	9,892	100,427	10,956	16,121	61,984
Simla	1,941	...	...	...	1,542	956
Kangra	165,452	12	1,141	1	6,188	119,995
Hoshiarpur	161,149	4,954	49,015	3,889	1,398	34,508
Jullundur	85,929	2,127	123,912	89	14	3,135
Ludhiana	51,715	20,285	63,998	2,097	263	2,529
Ferozepore	57,797	132,870	145,630	61,910	206	9,888
Lahore	54,117	15,002	82,092	9,038	374	20,634
Amritsar	47,826	2,095	(8) 94,407	395	321	39,188
Gurdaspur	72,992	(3) 6,318	(12) 63,141	5,117	1,364	58,787
Sialkot	79,234	14,758	65,163	14,649	3,395	64,800
Gujranwala	31,199	40,989	63,869	30,850	157	59,606
Gujrat	19,758	49,056	32,429	124,665	214	8,343
Shahpur	19,524	39,827	(2) 63,650	110,996	1,188	7,595
Jhelum	6,763	12,645	23,034	151,935	74	657
Rawalpindi	49,551	25,950	(1)* 15,540	107,347	16	1,468
Attock	23,978	24,687	20,828	191,831	...	113
Mianwali	15	23,239	1,127	105,332	20	1
Montgomery	17,880	9,798	43,400	7,874	3,684	19,044
Lyallpur	70,752	12,794	75,595	8,107	577	3,182
Jhang	13,903	54,149	17,678	13,548	4,038	2,656
Multan	4,379	75,894	44,856	42,055	7,069	26,895
Muzaffargarh	63	13,541	17,078	24,355	421	47,963
Dera Ghazi Khan	20	184,006	29,909	71,672	43	63,588
Total ...	1,206,645	1,342,870	1,485,345	2,412,497	55,988	712,843

* (1) The heading in crop return is *chára maweshi*, so other crops may be included.

(2) Of this 22,532 entered in rabi crop return.

(3) *Jowár* and *chari*.

(8) Includes *táramíra*.

(12) Entered as *chára*.

KHARIF 1910—RABI 1911.

Mundwa.	Wheat.	Barley.	Other cereals.	Gram.	Másh.	Múng.	Moth.
8	9	10	11	12	13	14	15
...	94,979	167,865	...	695,364	1,046	93,607	97,176
4	94,490	29,219	27	407,804	(5) 10,856	(5) 10,856	...
...	92,291	151,086	249	226,286	5,056	19,059	8,458
49	114,849	46,719	12,657	175,190	2,184	4,467	6,132
1,220	251,240	21,108	364	296,350	20,763	6,856	6,199
824	240,153	17,457	330	159,427	33,990	5,530	17,397
1,078	4,719	1,951	866	17	476	1	...
13,689	249,847	54,986	14,496	33,372	28,830	512	302
...	301,087	12,544	3,309	160,929	13,910	680	24,292
...	272,184	7,054	484	122,787	11,461	955	35,847
5	218,575	18,449	218	175,810	11,180	38,987	47,426
...	620,628	149,805	64	710,966	18,226	15,930	50,930
16	447,717	12,839	1,304	192,519	3,814	214	5,062
302	322,773	14,609	410	143,077	4,529	4,892	7,259
(4) 7,077	329,377	34,227	2,980	61,189	(6) 34,359	(6) 34,360	25,016
1,444	431,896	59,147	5,226	31,339	14,546	798	6,648
150	492,613	33,381	3,098	188,914	958	17,573	14,513
...	337,856	29,844	1,207	63,334	1,187	5,110	31,963
14	515,195	11,345	8,198	78,134	504	3,875	19,503
...	342,262	10,584	(13) 293	23,856	(13) 2,151	(13) 44,189	(13) 42,926
1,460	257,529	12,111	948	4,155	12,913	65,815	37,116
...	493,609	19,144	699	82,588	929	22,390	50,149
144	180,814	19,311	523	102,001	1,656	1,248	25,221
8	246,582	8,636	67	80,510	5,984	451	1,866
27	663,000	9,531	16	120,649	4,109	940	5,673
999	318,967	9,241	7,919	30,124	4,947	36	862
151	407,882	11,712	2,986	41,582	4,307	486	1,928
426	319,960	22,740	4,005	58,154	965	1,005	12,023
25	221,623	6,784	6,609	27,617	1,776	60	3,644
...			...	...			
29,112	8,884,697	1,003,429	79,552	4,494,044	257,692	399,882	585,129

(4) Includes *sánwak*.

(5) In Rohtak 21,712 acres are returned as *múng* and *másh*.

(6) In Gurdaspur 68,719 acres are returned as *múng* and *másh*.

(13) The figures for pulses are taken from district revenue registers and exceed those given in Annual Report by about 20,000 acres. There is a difference in the contrary direction under "Other cereals."

STATEMENT II.—Acres sown in Kharif

District.	Gwára.	Rawán.	Másri and Jawansari.	Peas.	Sarson.
1	16	17	18	19	20
Hissar	...	...	...	...	99,844
Rohtak	59,825	...	1,067	503	12,032
Gurgaon	67,138	35,441	...	2,149	16,970
Delhi	37,079	...	1,318	4,042	7,171
Karnal	...	...	18,829	173	47,698
Ambala	...	...	16,715	3,986	5,882
Simla	...	...	21	2	23
Kangra	...	...	2,190	724	6,890
Hoshiarpur	882	...	10,210	...	6,319
Jullundur	...	468	8,652	...	939
Ludhiana	...	...	2,488	...	15,288
Ferozepore	...	...	6,671	6	80,641
Lahore	...	...	3,576	30	(5) 18,089
Amritsar	1,448	...	4,407	...	2,174
Gurdaspur	...	...	21,990	...	(5) 5,356
Sialkot	...	...	31,538	24	(5) 2,128
Gujranwala	...	...	2,592	505	10,686
Gujrat	...	120	19,092	384	2,307
Shahpur	...	...	10,464	...	232
Jhelum	...	...	2,783	212	1,276
Rawalpindi	...	...	3,294	77	2,387
Attock	...	...	82	...	1,340
Mianwali...	...	1,042	19,876	...	210
Montgomery	...	462	1,142	(7) 15,126	694
Lyallpur	16,685	344	8,752	3,115	3,059
Jhang	...	5,756	4,690	11,943	127
Multan	...	9,163	3,553	40,856	1,638
Muzaffargarh	...	2,496	10,425	45,014	396
Dera Ghazi Khan	...	...	9,349	20,100	...
Total ...	183,057	55,292	225,757	148,971	351,796

(7) *Churál*, &c.

(5) Includes *táramíra*.

1910—RABI 1911—*concluded.*

Toria.	Táramíra.	Turnips and carrots.	Fodder (rabi).	Cotton.	Cane.	Other crops. (14)	Total.
21	22	23	24	25	26	27	28
11	30,595	201	1,782	68,774	1,082	178,046	2,437,899
8	3,082	...	1,458	72,317	18,820	19,632	1,169,706
68	10,154	1,935	1,254	91,165	6,117	19,564	1,141,149
66	5,255	...	9,892	39,432	17,442	21,032	685,518
7,541	4,190	738	15,300	67,452	22,937	43,313	1,195,999
2,187	12,697	88	1,539	54,164	14,973	32,336	915,338
...	...	4	...	2	...	1,408	15,007
2	...	4	24	4,136	5,206	77,112	785,161
176	1,228	...	16,346	17,473	27,795	67,524	919,617
60	201	...	66,542	27,977	29,171	36,546	830,534
...	...	596	23,864	17,880	8,769	51,099	771,521
75	21,906	1,841	27,959	4,423	2,110	133,452	2,253,934
59,224	...	14,990	85,139	112,102	13,326	59,209	1,210,427
24,378	477	314	80,522	38,602	27,531	26,893	888,829
2,955	...	76	35,889	11,524	60,808	44,420	919,322
10,006	...	2,508	71,809	23,380	41,785	30,786	1,007,005
(10) 36,661	1,162	23,698	60,781	56,774	28,579	30,753	1,230,061
446	6,624	10,584	21,448	12,278	10,530	20,059	808,838
81,472	5,710	41,707	16,522	94,814	8,189	38,818	1,177,476
...	13,699	1,131	(11) 11,004	12,065	368	17,393	721,300
...	3,701	180	145	6,751	147	12,773	621,374
...	19,347	146	3,965	21,804	1,861	14,224	993,714
...	13,814	7,733	1,345	2,664	34	33,174	540,544
10,318	1,900	43,210	15,951	32,787	1,051	37,368	605,793
192,140	1,496	4,421	...	137,628	38,789	178,697	1,560,078
11,924	606	36,198	14,202	43,310	1,247	64,344	673,414
...	14,276	59,426	23,983	85,639	2,973	74,735	988,424
283	11,346	22,791	12,120	43,289	7,944	39,402	718,205
...	(9) 81,806	6,032	3,235	49,171	105	24,480	811,654
441,001	265,272	280,552	618,020	1,249,777	399,689	1,428,592	28,597,401

(9) Includes *sarson* and *toria*.
(10) Figures from Annual Report of Department of Agriculture.
(11) Includes turnips and carrots.
(14) Difference between last column and total of preceding columns.