FACTORS AFFECTING YIELDS OF WINTER WHEAT GRAIN AND FORAGE

in the Southern Great Plains

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FACTORS AFFECTING YIELDS OF WINTER WHEAT GRAIN AND FORAGE IN THE SOUTHERN GREAT PLAINS [1]

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During the war years of the forties, grazing of winter wheat became an important source of cash revenue to wheat farmers. Whether grazing reduced grain yield, and if so how much, was of interest to farmers. Some operators tried the practices of heavier rates and/or earlier dates of seeding than were common for grain production to increase pasturage.

This study of data from pastured fields surveyed in cooperative research of the (U. S.) Soil Conservation Service and the State experiment stations of Colorado, Kansas, New Mexico, Oklahoma, and Texas has been made through the aid of Oklahoma Agricultural Experiment Station's Statistical Laboratory facilities. It consists of two approaches to the question of the effect of grazing on grain yield. The extent of possible grazing was judged by the yield of pasturage cut in the tests. Also, an analysis was made of other factors that might relate to pasturage and grain yield.

The area of study consists of parts of the southern Great Plains where grazing of winter wheat was a common practice during the period of record, 1946-51. It includes the Panhandles of Oklahoma and Texas, and a few Soil Conservation Districts in the five States immediately adjoining the Panhandle High Plains. This area is part of the extensive ranching territory of the Southwest.

EFFECT OF GRAZING ON GRAIN YIELD

There were available 884 records of grazing winter wheat in 23 locations. Altogether, the first approach involved 51 time and place combinations for direct comparison of grazed and ungrazed grain yields. An average of all yields from grazed fields was entered against an average of an equal number of nearby fields that were not grazed, unless the grazed fields were in the majority, in which case all available records for grazed and ungrazed fields were used.

Average grain yields of the 51 comparisons were 14.6 bushels per acre for grazed fields and 14.8 bushels per acre for ungrazed fields.

The second approach was by correlation analysis. The variable in question, yield of forage dry matter removed per acre by grazing, was included in multiple correlation to grain yield with several other factors. The same group of factors was correlated also to forage yields. Standard partial regression coefficients were selected as the best measure of independent effect of each variable. Variables which showed a significant relation to either forage or grain yield through the standard partial regression coefficient are included in the tabulation (table 1). As to the effect of varying the amounts of forage dry matter removed per acre by grazing on grain yields, no significant relation was observed. (See first entry in table 1.)

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Table 1.--Standard Partial Regression Coefficients and Multiple Correlations (R) of Factors Related to Grazing Yields or Grain Yields of Wheat, n = 884.

Factor	Regression coefficients for--	
	Forage yield (Cwt. per Acre)	Grain yield (Bu. per Acre)
Grazing Yield, (Cwt. per Acre)	----	.008
Soil Texture, (Index)[1]	-.050	-.102**
Slope, (Percent)	-.107**	-.057*
Amount of Tillage, (Inches Soil Stirred)	-.046	.120**
Weed Growth, (Visual rating)[2]	.117**	-.079**
Insect Infestation, (Visual rating)[2]	-.083	-.617**
Water Conservation Practices (Index)[2]	.073*	-.035
Stubble Mulch, (Visual rating)[2]	-.003	-.070*
Total Rainfall Grazing Period, (Inches)	.007	.453**
Amount Weekly Rain (Prep. Period), (Inches)	-.144*	-.170**
Amount Weekly Rain Grazing Period, (Inches)	.031	-.234**
Initial Soil Moisture, (Depth-Inches)	.190*	.341**
Lateness of Planting, (Weeks)	-.010	.057*
Length of Grazing Period, (Weeks)	.268**	-.214**
	R = .3614	R = .7413

*Significant at 5-percent level.
**Highly significant at 1-percent level.

[1] Rated numerically by soil class, 1 for clay and increasing number for each coarser textural class.
[2] Rated numerically, 0 or 1 for negligible magnitude and increase number for increasing intensity.

OTHER FACTORS AFFECTING FORAGE AND GRAIN YIELDS

Topsoil texture varied from clay loam to loamy sand. Soil texture did not significantly affect forage yield, but higher grain yields came from the finer textured soils.

Land slopes ranged between 0.5 and 5 percent. Flatter lands produced highest yields of both grain and forage. Yields of forage were much lower (highly significantly so) on steep slopes, and grain yields were significantly lower there than on gentle slopes and flatlands.

Amount of tillage performed in preparation for seeding was measured as a sum of inches of soil stirred by all preparatory field operations. It did not affect forage yield but was positively related to grain yield, probably a result of more adequate weed control.

Weed growth during preparatory period contributed to pasturage production to a highly significant extent, obviously because of the palatable nature of some of the weeds, but was strongly depressing to grain yield by reducing the moisture and fertility level in the soil.

Degree of insect infestation varied widely between times and places but was severe enough occasionally to reduce grain yields. Pasturage was not greatly affected. Greenbug or green aphid (Toxoptera graminum) was the principal insect encountered.

The practice of water-conservation methods such as terracing, contour tillage, and strip cropping benefitted pasturage yield to a measurable extent but showed no significant relation to grain yield.

Stubble mulching, on the other hand, depressed yield of grain without affecting pasture yield. The value of stubble mulching may depend on its efficiency in preventing wind erosion and conserving moisture, factors which often compensate for a slight loss of yield.

Total rainfall coming during the grazing period did not affect yield of pasturage but was very positively related to subsequent grain yield. However, excessive rain as indicated by a high weekly rate of rainfall during both preparatory period and grazing period reduced grain yield, yet affected pasturage yield during the preparatory period only. These reactions to wet and dry periods are best explained by the highly significant negative simple correlation (-0.279) between rates of rainfall in the summer preparatory period and the following fall and winter grazing period. The fact that a wet summer was usually followed by a dry fall during this particular period of observation (1946-51) does not make this a permanent rule, but simply explains the moisture relations observed in this study.

Initial amount of soil-stored water affected favorably the yields of both pasturage and grain.

The most common planting date was about mid-September, just 1 month before the recognized most favorable date for grain yield. This reflects strongly the prevailing idea of early sowing to enhance pasturage. Extremes ranged between late August and early November. Statistical treatment showed no significant correlation between sowing date and pasturage yield, but long-time experiments which show late seeding within this range to be favorable to higher grain yields were confirmed. Therefore, early sowing does not enhance pasturage.

Length of grazing period naturally was highly correlated with forage dry matter removed, but was significantly correlated to reduced grain yield.

Finally, there was no significant dependence of grain yield on amount of pasturage taken from the fall and winter growth of wheat.

It should be pointed out that these observations were obtained from average farmers operating in the manner to which they were accustomed; a manner which includes such practices as taking cattle off of muddy land and ending the grazing season before wheat joints begin to lengthen noticeably in the spring.

The general conclusion from this study, covering a period in which wheat yields were a little better than average, is that grazing can be practiced with commonly accepted precautions without harm to the land or substantial reduction of grain yield. Fall and winter grazing of wheat in the Southern Winter Wheat Regions, therefore, should be recognized as a productive practice. Its feasibility need not depend on conditions more difficult to satisfy than providing for necessary fencing and water.

These statistics indicate that undue lengthening of the grazing period should be avoided. It was apparently not the amount of forage removed by grazing but length of time the grazing period was extended that reduced grain yields.