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The Ecological Effects of Different Preceding Crop Plants on *Setaria Glauca* in Flax¹

While a number of studies have been made of the effect of one crop on succeeding crops, the effects of a crop on the weed populations of succeeding crops have been generally overlooked. Thus this investigation was designed to explore the effects of a previous crop of corn, oats, wheat, soybeans, or flax on the population of yellow foxtail (*Setaria glauca* (L.) Beauv.) growing in a flax crop.

METHODS

A crop sequence plot has been in existence for at least a decade at the Agricultural Experiment Station, Rosemount, Minnesota, in which corn, wheat, oats, flax, and soybeans succeed each other in a planned sequence. These plots are replicated four times and each of the 100 plots is 42 feet square. The studies reported here were made only in the 4 replicated plots of flax following each of the 5 crops.

From each of the four flax plots, three subplots were selected, each one square yard in size, and at maturity of flax, in July, the following data were taken: number of flax plants, number of weeds by species, plant dry weight by species, and seed yields of flax. In addition, 40 plants were selected at random from each of the 12 subplots and the following data obtained: plant height, number of tillers per plant (for grass weeds), number and length of inflorescences (heads) per grass weed, and number of capsules (bolls) per flax plant.

Shortly after emergence of flax, the plots were sprayed with the amine salt of 2-methyl-4-chlorophenoxyacetic acid (MCP) at 3 oz. per acre. This eliminated many of the broad-leaved species of weeds

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and probably accounts for the relatively high population of yellow foxtail found.

RESULTS

Effect of a preceding crop on plant density and species composition: Flax was sown in plots in which oats, wheat, corn, soybeans or flax was grown the previous year. The total number of both flax and weed plants was determined and the results are in Table 1. The plant population was highest after oats, lowest after flax, and intermediate after wheat, corn and soybeans. Yet the dry weight of all plants per unit area was about the same following oats or flax. On a species composition basis flax was outnumbered by foxtail plants in plots following oats but flax outnumbered foxtail plants in plots after flax.

TABLE 1.—*The effects of 5 different preceding crop plants on plant density and percentage composition of species of plants growing in plots of flax.*

Flax plots preceded by	FLAX AND WEEDS PER SQ. YD.		PLANTS PER SQ. YD., IN PER CENT		
	Number	Dry weight, in gm.	Flax	Yellow foxtail	Other weeds*
Oats	1010	684	44	54	2
Wheat	853	553	54	41	5
Corn	829	509	53	45	2
Soybeans	806	706	49	48	3
Flax	676	636	52	40	8

*These weeds include *Echinochloa crusgalli* (L.) Beauv., *Polygonum Persicaria* L., *Ambrosia artemisiifolia* L., *Amaranthus retroflexus* L., *Digitaria sanguinalis* (L.) Scop., *Setaria viridis* (L.) Beauv., and *Panicum* sp.

Effect of a preceding crop on yellow foxtail in flax: As shown in Table 2, foxtail plants were most abundant following oats and least abundant following flax. However the plants after flax were larger (as measured by dry weight), were taller by 20 cm, had longer heads, and averaged slightly more heads per plant than did foxtail plants following oats. Despite the larger plants and longer head lengths of foxtail following flax, the yield of foxtail seed was about the same as that following oats if the method for calculating yield is reliable. Actual yields were unreliable as some foxtail seed was lost in the harvesting operations.

TABLE 2.—*The effects of 5 different preceding crop plants on the growth of Setaria glauca in flax.*

Observation*	FLAX PLOTS FOLLOWING				
	Oats	Wheat	Corn	Soybeans	Flax
No. of plants per sq. yd.	559	353	377	392	272
Dry weight, mg. per plant	665	709	650	932	1162
Height, in cm.	48.7	55.3	58.0	65.8	68.7
No. heads per plant	1.2	1.2	1.3	1.2	1.6
Head length, in cm.	4.2	4.7	4.7	5.3	5.7
Seed yield per sq. yd., in gm.†	98	88	87	111	96

*Based on averages of 40 plants from each of 12 subplots.

†Calculated as a product of average head length, the number of heads per square yard, number of grains per cm. of head, and the weight per grain.

Effect of preceding crops on flax: The preceding crop affected flax also as shown in Table 3. There were fewer flax plants, shorter plants, lower dry weights per plant, fewer bolls per plant, less seed per plant, and lower yields per acre when flax was sown after flax than when sown after any of the other four crops. However no one preceding crop gave the highest value for all items measured. For example, flax plants were more numerous on wheat land, were tallest on corn land, had the highest dry matter values on soybean land, produced the most bolls per plant on corn or soybean land, produced the highest seed yield per plant on soybean land, and yielded best per plant on soybean land, and yielded best per acre on wheat, corn or soybean land.

TABLE 3.—*The effects of 5 different preceding crop plants on the growth and development of flax.*

Observation*	FLAX PLOTS FOLLOWING				
	Oats	Wheat	Corn	Soybeans	Flax
No. plants per sq. yd.	414	460	424	394	357
Plant height, in cm.	51.2	50.9	54.9	52.6	44.0
Dry weight per plant, in mg.	587	487	583	691	325
No. bolls per plant	7.0	6.4	8.0	7.8	5.0
Weight of seeds per plant, in mg.	121	104	127	154	76
Flax yield, bushels per acre	8	11	11	10	5

*Data based on averages of plants from 12 subplots, each one sq. yd. in size for "no. of plants per square yard" and for "flax yield". For the remaining items, data are based on 40 plants taken from each of 12 subplots.

DISCUSSION

The results reported here are important because the previous crop is shown to affect the population of a given weed species under normal field conditions. Moreover there is not the complicating factor of foxtail growing in different crops as foxtail was growing in flax sown at the same rate of seeding in all plots. Obviously the preceding crop could alter the characteristics of the soil to either favor or not favor foxtail.

It is significant also that previous cropping to flax reduces the number of both foxtail and flax plants, but the foxtail plants are bigger and more vigorous on flax land while flax plants are smaller and less vigorous on flax land.

Despite the relatively high populations of foxtail after oats, the potential amount of seed falling per unit area was no higher than it was where the foxtail plants were fewest per unit area. Thus no one preceding crop resulted in greater seed production of foxtail seed per unit area in the succeeding crop of flax in which foxtail was found.

SUMMARY

Plots of land previously cropped to oats supported the highest population of crop and weed plants and plots previously in flax supported the lowest population. Yellow foxtail was most abundant in flax preceded by oats, and least abundant in flax preceded by flax; however the foxtail plants were larger, taller, tillered more, and had longer inflorescences when growing in flax after flax than growing in flax after oats. The data for foxtail in flax after wheat, corn or soybeans were generally intermediate between those for flax after oats or flax.

For flax plants, there were lower densities, smaller plants, fewer bolls per plant, and lower yields of seed per plant and per acre in plots of flax following flax compared to flax following corn, oats, wheat, or soybeans.