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WEEDS, A TOOL FOR TEACHING HIGH SCHOOL AGRICULTURE

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Weeds can be interesting. Well, possibly they can, but that is not the most frequent reaction we get from students. Too often the study of weeds gets to be a jumble of apetalous, decumbent, and perigynous terms, mixed with a dash of dried herbs and tiny seeds that tax the patience of our younger saints. This begins to sound like a protest against present teaching methods used in the botanical field. Far from it. We simply wish to call to mind the responsibility we share in giving students a correct outlook and the desire for learning. That is why this article was written.

How viewpoints are established or desire for learning is encouraged probably falls in the realm of methods, but this is just an account of some of the studies a group of vocational instructors tried out recently with their students. Naturally it concerns weeds, as you can readily see, judging by the title and what we first mentioned.

What high school instructor in Agriculture or Botany instructor in college hasn't told his class that weeds compete with crops, reducing yields, and in one way or another interfere seriously with crop production, cost a great deal to control, and are in general a bane to farm existence. Comes next the story of how corn yields have been increased greatly as a result of weed control at the experiment stations. The student studies weed plants and seeds and learns among other things to recognize them. But Merle Mooney, James McGowan, Bill McCullem, and many more future farmers have long been in close contact with weeds from the earliest day they were sent out to weed the garden and they already know that you have to cultivate corn to get a crop. "Of course a fellow has to know about creeping jenny and leafy spurge, if he is going to farm, but these other weeds they call annuals are not so important."

Making use of the principle of "learning by doing," R. H. Hoberg, C. E. Luke, J. W. Nelson, J. V. Raine, Wayne Keck, Marcel Cox, and Elvin Thue, teachers of agriculture in Minnesota, projected classroom studies of these "unimportant" annual weeds onto the boys' home farms in a very practical manner. Comparing yields of flax under weed-free and weed-infested conditions, these instructors and their students are convinced that annual weeds really do matter. They established a difference of 4.96 bushels per acre in favor of flax grown free of weeds in the season of 1945, when flax yields were high and weeds were considered to be less of a factor than in previous seasons. Cooperating students, comparative yields, and differences are given in table I. The data were analyzed statistically and found to be highly significant. In fact, the odds that a difference as large as this might be due to chance alone are 1 in something over 100,000.

Glen Johnson, Ortonville, demonstrates difference in height and development of weed-free flax, right; and weed-infested flax, left.

Data on the effect of weeds on flax seed yields were obtained on paired comparisons from 30 farms in seven Minnesota communities. Two trials were discarded as they did

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not conform to the design of the study. Weed-free flax consisted of a single rod row in a flax field kept weed-free by hand weeding, with sufficient area surrounding the row to avoid border effect. A second row not more than ten feet distant in an area undisturbed as to weeds provided the comparison under weed competition. In selecting the second row an effort was made to secure a row with a stand of flax comparable to that in the weed-free row. The two rows were pulled separately when ripe, threshed, and yields computed. Cooperating boys hand-weeded their flax and harvested the rows with the help and under the supervision of their instructors in most cases. The harvested materials were handled at University Farm with the help and cooperation of Dr. J. O. Culbertson.

Pigeon grass or foxtail was common to all hand-weeded strips and was removed. The adjoining unweeded rod contained this and other annual weeds in varying proportions at maturity. The weeds encountered were mostly annuals as listed in table II.

The greatest value in these data lies in considering the average difference for all 28 comparisons. Differences in yield between weedy areas and weed-free areas for each farm probably do not represent the real difference on any one farm. It must be recalled that the area harvested in each case was very small and thus hardly representative of the field. However, production on the weed-infested strips agreed well with the reported yield for the respective fields, and the calculated yields are not far from those actually obtained.

Table I. Yields of Flax in Weedy and Weed-Free Areas in innesota in 1945

Cooperator	Yield in bu. weedy area	Yield in bu. weed-free area	Diff. in bu. per acre
Bill McCullem	14.76	21.62	6.86
Glen Johnson	20.58	23.70	3.12
Paul and Stan Lindholm	16.01	28.27	12.26
Justin Scholberg	24.74	21.62	—3.12
Pat Berdan	21.20	26.61	5.51
Eugene Nelson	22.03	22.45	.42
Arlene Lacombe	20.79	25.98	5.19
Merle Mooney	18.08	22.24	4.16
Richard Frederickson	14.13	17.67	3.54
Lloyd Elton	22.66	24.74	2.08
John Londgren	17.46	20.68	3.22
Kerman Benson	22.45	25.77	3.32
George Roggow	11.64	20.79	9.15
Allen Hauge	20.37	27.23	6.86
Kenard Frederickson	22.86	25.77	2.91
Kermit Twait	20.37	22.24	1.87
Milo Siewert	8.73	16.00	7.27
Raymond Karschnick	24.32	25.98	1.66
Edward Carroll	7.48	23.49	16.01
Donald Matasovsky	14.55	16.01	1.46
Clinton Tordson	17.46	22.24	4.78
Dale Grein	9.77	25.36	15.59
Paul Calvin	21.20	22.24	1.04
Bill Bergen	14.97	24.53	9.56
James McGowan	26.19	29.72	3.53
Melvin Rogers	13.30	16.21	2.91
Melvin Rogers	16.63	16.63	0.00
Stewart Kanis	17.67	25.36	7.69
Averages	17.94	22.90	4.96

August plowing of stubble and working of land shows promise for weed control, foreground; plowed only, background

Table II. Summary of the Dates of Emergence of Annual Weeds on Fields Sown to Flax, Oats, and Planted to Corn in 1944, and on Fields Sown to Flax and Oats in 1945. Records Involve Inspections on 53 Fields.

Weeds	Number of cases seedlings occurred, according to inspections at intervals of one week								
	April 29-May 4	May 5-11	May 12-18	May 19-25	May 26-June 1	June 2-8	June 9-15	June 16-22	June 23-29
Common mustard	9	14	35	33	33	33	25	8	6
Wild buckwheat	4	20	26	26	29	27	22	10	9
Pigweed	2	3	13	12	14	15	12	5	4
Lamb's-quarters	1	5	17	22	21	23	17	12	10
Foxtail	7	18	25	32	37	38	30	13	11
Barnyard grass		3	3	14	7	8	6	4	4
Ragweed	2	11	25	30	28	28	25	11	11
Smartweed				1	1	2			

Results obtained emphasize the importance of sowing flax on clean ground, and indicate in some measure what may be accomplished by better weed control than is now practiced. This study also brings out the fact that weeds account in part for the wide variation in yield from farm to farm, as indicated in the reduced variation in yields under weed-free conditions. It is not to be expected that flax will be grown weed-free, but it appears highly probable that yields of flax may be increased by one bushel per acre, possibly more, as a result of more thorough weed control and careful selection of land for sowing flax.

Teaching Method

As a teaching aid the plan appears to have merit. The practical appeal to the student should not be overlooked. It is not very difficult for a student to see that a bushel more flax seed per acre means $2.91 more return or $5.82 more for a two-bushel increase at current prices for seed. Furthermore, clean flax straw is a marketable product which will increase the return per acre by an additional $1.50. Flax straw represents a phase of flax production which has developed into a state industry bringing 5¼ million dollars annually into Minnesota. We do not for a moment believe that all teaching should have some practical motive behind it, but certainly the apathy in regard to annual weeds requires some pretty drastic revision of our viewpoints, and this appears as good a point at which to start as any. The study of weeds moves out of the position of a required study to one the student feels is essential to his future welfare as a farmer. Certainly a desire must be stimulated to learn more about weed control and how or when control methods may be effectively applied.

Group results rather than individual results are of most value in this type of program, and a coordinating agency is indicated. The same type of study is adapted for wheat, oats, or barley, and needs to be considered beyond the area adapted to flax. You perhaps question whether any real differences can be shown in these latter crops. The best answer is to try it and convince yourself.

Seedlings

Another plan used in both the 1944 and 1945 seasons covered a study of the period in the spring when seedlings of weeds appeared to emerge. The study was designed primarily to aid students in learning at first hand when general field working in the spring might be employed effectively to destroy seedlings. Sprouting of weeds on grain fields was tabulated on the basis of the dates on which seedlings of the various weeds were found. Inspection of fields was made at weekly intervals. The period when most records showed any particular weed appearing was taken as an indication of the approximate time when that weed was emerging during 1944 and 1945. The spring season in both years had much in common in that warm growing conditions were much delayed, and afforded an opportunity for any hardy individuals to show their adaptability to low temperatures. The data for the two seasons were combined and are summarized in table II.

From the records it was apparent that annual weeds sprouted most abundantly from about May 12-18 through the spring period. There appeared to be a tapering off in weed sprouting late in the spring or early summer when higher temperatures would be expected. This seems to agree with earlier established data (1), (2), that optimum temperatures for weed sprouting are encountered. Records were kept also of the sowing dates for flax and grain on these farms. The records indicated that weeds emerged a full month to six weeks after grains were sown or had produced growth above ground.

What can the student acquire in the way of experience or knowledge from such activity? The responsibility of the instructor enters here again in directing the student's thinking toward a correct interpretation of his findings. It would seem very obvious that early working of the land in the spring for seedbed preparation may not be an effective control for annual weeds in flax or early sown grains at least for the seasons of 1944 and 1945. It also must appear that control of the annual weeds must be tackled at some other point in the farming operations.

Mustard and lamb's-quarters seedlings readily identified at an early stage.

If weeds were to be controlled in the spring before seeding flax, it would be necessary to delay flax seeding about two months, according to these data. Late seeding of flax has been shown to produce lower yields than has early seeding. One of the answers to weed control for flax must be cleaning this land the previous season, and avoiding the more deeply buried weed seeds by relatively shallow working of the land in the spring in preparing the seedbed. Another point might be gleaned is that early sown flax would appear to be subject to competition from fewer weeds in its early development than late-seeded crops. What would be the situation in another season when warm growing conditions are experienced early in the spring is something else again. These data on seedling emergence are not considered as a critical measure, and caution must be used by the instructor and the students. The group observations again are more useful than the individual ones and a coordinating agency is required to maintain uniformity and to bring together results.

This phase of the study had its limitations. Tabulation of seedlings emergence required identification of weed seedlings. But seedling identification apparently is not included in botanical courses. A Kansas publication, (3), has considered this angle, but instructors like the majority of college graduates including the writer had little previous experience upon which to draw. A reasonable proficiency was soon acquired with a few of the most common weeds encountered.

To this point we have presumably convinced our students that annual weeds must be controlled, and the job has to be done the previous season to sowing flax or small grain. Considering grain stubble as an obvious source of weed seed infestation, and a point at which weed seed formation might be prevented, as well as an opportunity for sprouting newly turned up seeds, students undertook the plowing of strips of grain stubble in early August. A part of the plowed strip was left rough and the remaining part lightly worked to provide a seedbed for sprouting seeds. Results were very gratifying in 1944, as students' records indicated weed sprouting comparable to that found in the spring. Acute labor shortage in 1945 prevented continuation of this phase of the study. Preliminary data indicated that the same weeds which were found in the spring could be sprouted equally well in late summer and early fall. In most cases the growth of weeds and volunteer grain afforded ample protection of the land against wind erosion over winter, the plants having been killed by the fall frosts.

There are obvious disadvantages to this type of program study, and the success of it depends to a great extent upon how the instructor regards the plan and presents it to his students. One group of boys was greatly interested in what kind of results they would get, while another group was "glad to help Central Fibre Corporation in carrying on the study." It is not the intention to turn high school students into research assistants. In fact, the study as carried out by the boys was more of a visual demonstration on their own farms of just how badly annual weeds affected the yield and development of flax on this part of their field.

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