Quackgrass Root Extract Has Puzzling Effect On Seeds Of Crop Plants

By E. A. Helgeson[1]

As part of our research program in control of perennial weeds we have been looking for some of the basic reasons why:

1. **Certain weeds seem to thrive in certain crops.**
2. **Crops are often seriously reduced when growing in competition with weeds such as perennial sowthistle, quackgrass, or leafy spurge.**
3. **A good stand of grass or alfalfa will suppress the growth of such perennial weeds as leafy spurge and Canada thistle while the alfalfa is beneficial to the grass.**

We know in a general way that weeds and crops compete for moisture, light and mineral elements, but this competition does not seem to give us all the answers as to why weeds are so detrimental to crops. Certainly one of the logical places to look for answers is in the character of root systems, both in weeds and in crops.

Alfalfa and spurge develop deep roots which are adapted to feeding in soil levels below those in which grass and cereal roots grow. These plant types often grow together in the same area. This sort of two story feeding probably explains why legumes and grasses grow so well together. This does not tell us, however, why we often find a sickly yellow growth of corn in a patch of perennial sowthistle. Nor does it tell us why we frequently get a stimulation of growth in crop plants growing on old quackgrass sod, or why certain types of annual weeds appear to be more numerous on this same quack land.

A number of years ago agricultural workers thought that perhaps a partial explanation for the stimulating or depressing effect of one plant on another might be due to substances excreted by roots or to material liberated when roots or tops decayed. While most of the early experiments were inconclusive, enough evidence seems to be present to warrant a further search for toxic plant substances.

We have now shown that tops, roots or seeds of many of our weeds do indeed have water soluble materials which are highly toxic to the growth of young seedlings. A rather surprising result of our studies in this field is that while a concentrated extract of quackgrass roots produces poisonous water soluble compounds, more dilute water extracts cause a stimulation in early seedling growth of some crop plants.

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In the summer of 1955 quackgrass rhizomes (underground stems) and roots were taken from Fargo soil then carefully washed and dried in a steam oven at about 158° F. The dried material was ground to a fine powder and portions were placed in distilled water. Flasks containing this material were placed in a mechanical shaker for a period of one hour after which the extract was filtered off. This extract was used to moisten filter papers placed in a large covered glass dish and 100 seeds of each crop type were immediately placed between sheets of the moistened paper. Two such dishes were used for each trial. At the end of five days after incubation in a germinator at 70° F., the length of seedling roots was measured. One hundred measurements were taken for each test. Growth expressed in per cent of a control lot grown in water only is presented in the table below. The figures in the left hand column indicate concentration of extract, 1:10 being one gram ground quack rhizomes in 10 milliliters of water, etc.

TABLE I.—**Growth and Germination of Seedlings of Several Crops in Quackgrass Extracts.**

Conc. of extract	Alfalfa		Flax		Wheat	
	gm*	grt*	gm	grt	gm	grt
H20	86	100	80	100	86	100
1:10	80	101	85	97	85	102
1:20	78	113	82	104	85	105
1:30	84	111	85	107	85	108
1:40	78	115	82	108	85	104

*gm—% germination. grt—root growth in % of control.

From the data shown it is clear that the extract generally has little effect on the per cent germination of the several crop seeds. The more concentrated extract (1:10) had little or no effect on growth of roots but the more dilute extracts showed a definite stimulation of growth with a tendency to a greater stimulation as the extracts became more dilute. These results confirm similar data obtained in Sweden by Hugo Oswald in 1947. Dr. Oswald used native quack rhizomes and tested the extract on tame oats and rape. (Vaxtodling 2:288-303).

No explanation can be offered at present for the nature of the substances present in our quackgrass material but studies are being made on this problem in our laboratory. The finding of definite stimulating or toxic natural plant products can lead to the development of specific chemicals for the control of this pest.

EXPERIMENT STATIONS ARE FIRE FIGHTERS

Director James G. Horsfall of the Connecticut (New Haven) Agricultural Experiment Station says:

"Many people look upon us here at the Experiment Station as fire-fighters. The 'fires' we fight cover the whole range of problems in plant growing and some others, besides—apple scab in the orchard, fertilizer deficiencies on the farm, ants in the gardener's lawn, silverfish in his library, poisoning of pets, analytical data for the courts, gypsy moths in the forests, mosquitoes in the drive-in movies. The fires we fight are both big and small."—From Frontiers of Science, Connecticut Agricultural Experiment Station, New Haven, Vol. VII, No. 1, November 1954.