

PROBABLE EFFECT OF WEEDS ON THE FERTILITY OF SOILS

H. J. SNIDER

University of Illinois, Urbana, Illinois

Weeds, whether native or introduced, have been with us so long that they are taken for granted. Little attention has been given to such a matter as the important chemical elements they appropriate from the fertility of the soil.

Experimental.—During the autumn season, October and November, of 1938, some 50 samples of different species of native weeds common in central and northern Illinois were collected and a rather complete chemical analysis was made on each of the samples; also an analysis was made of the soils taken from the areas where the weeds grew. Individual plants were separated into roots and tops and the chemical composition was determined on the two portions of the plants. The weeds at time of sampling were in a more or less mature condition, that is, either in bloom or in the seed stage.

Composition of Soils.—The species of wild plants here considered were taken from soils which were in a rather high state of fertility.* Soil reaction ranged from pH 5.2 to 7.1 with an average of pH 6.2. Total nitrogen ranged from 5,160 pounds to 10,700 pounds, with an average of 8,200 pounds in 2,000,000 pounds an acre. Some analytical work reported on soils from various Illinois experiment fields indicates that the most productive of these fields ranged in nitrogen content from approximately 3,000 pounds to 5,000 pounds an acre. Soluble phosphorus content of these weed soils ranged from 80 to 300 pounds an acre, and available potassium from approximately 200 pounds to 400 pounds an acre. Of these three essential elements (N, P, and K) the soils had an abundant supply.

Composition of Weeds.—From an agricultural soils viewpoint, probably nitrogen might be considered the most important chemical element contained in the weeds. There was considerable variation in the nitrogen content of the thirteen species of weeds and also a relatively large variation in the nitrogen content between the roots and tops within the same species. Nitrogen found in the tops varied from 3.21 per cent in yellow dock

(*rumex crispus*) down to .65 per cent found in prairie dock (*silphium terebinthinaceum*). Nitrogen content of the yellow dock compared favorably with the best soil-improving legume crops such as alfalfa, sweet clover, etc., while the nitrogen content of prairie dock compares with such low-nitrogen crops as timothy, redtop, cornstalks, etc.

Roots are probably the most important portion of the plant in improving or retaining the fertility of soils, while the tops of weeds are probably an important factor in causing losses of fertility. If weeds are burned on the land, the nitrogen contained in the tops is largely lost; while the mineral elements (P, K, Ca, Mg, Fe, Mn) are largely retained in the ash and may be returned to the soil. Whatever disposition is made of the tops, the roots of weeds usually remain in the soil and may be considerable aid in replenishing some of the elements in a more or less available form.

The high phosphorus content of the weeds (tops) .39 per cent in yellow dock was slightly higher than an average for the spring growth of sweet clover, .34 per cent and the low of .06 per cent in common smartweed (*polygonum hydropiper*) compares in amount with such material as wheat straw and oat straw.

In comparison with some farm crops the potassium content of the weeds was relatively high. Alfalfa on the Carlinville Experiment Field, September 4, 1936, had a potassium content in the tops on several plots which ranged from .62 per cent to 1.17 per cent and in the roots it ranged from .46 to .72 per cent. Potassium content of the weed tops ranged from .98 per cent in golden rod (*solidago canadensis*) to 2.80 per cent in yellow dock and in the roots from .65 per cent in milkweed (*asclepias syriaca*) to 2.44 per cent in wild parsnips (*pastinaca sativa*). Bluegrass, which is a high-potassium crop, had a percentage which ranged from 1.56 per cent to 2.80 per cent. Some of the richer samples were taken from potash-treated plots on the Clayton field May 16, 1938. These analyses in-

dicating a possibility of considerable loss of potassium from soils by improper handling of weeds.

The calcium content of the weed tops ranged from .60 per cent in common smartweed to 2.06 per cent in common thistle (*Cirsium lanceolatum*) and the magnesium content ranged from .25 per cent in wild lettuce (*Lactuca canadensis*) to .87 per cent in yellow dock. Comparing these values with those of alfalfa on the Hartsburg field it was found that seven plots sampled at three dates during 1937 ranged in calcium content from 1.20 per cent to 1.86 per cent, and magnesium content ranged from .33 per cent to .56 per cent. Bluegrass from the Clayton field, in 1938, has a calcium content ranging from .14 to .36 per cent and the magnesium ranged from .15 to .27 per cent. The weeds compared favorably

with the above two crops, one relatively high and the other relatively low in calcium and magnesium.

Manganese content of the weed tops was relatively low because of the rather high pH of the soils. The iron and manganese content of the roots was unreported because it was apparently impossible to wash from the roots the adhering particles of these elements which were present in sufficient quantities to contaminate the samples and cause the percentages to be unusually high.

Two species of wild native grasses, bluestem (*Andropogon furcatus*) and slough grass (*Spartina michauxiana*) which, technically speaking, are not weeds, were included in the table for the purpose of comparison.

All analyses were on air-dry basis.

CHEMICAL COMPOSITION OF SOME COMMON WEEDS IN ILLINOIS

Plant species with common name	Part of plant	N		P		K		Ca		Mg		Fe		Mn	
		%	%	%	%	%	%	%	%	%	%	%	%	%	
<i>Rudbeckia subtomentosa</i> (prairie coneflower)	Tops	.88	.15	1.17	1.14	.40	.03	.0015							
	Roots	1.63	.18	1.17	1.04	.26									
<i>Pastinaca sativa</i> (wild parsnip)	Tops	2.02	.29	2.18	1.10	.43	.02	.0034							
	Roots	1.06	.27	2.44	.24	.35									
<i>Lactuca canadensis</i> (wild lettuce)	Tops	.91	.19	1.86	.91	.25	.02	.0030							
	Roots	.42	.19	1.86	.26	.19									
<i>Ambrosia trifida</i> (horseweed)	Tops	1.40	.30	1.32	1.78	.48	.01	.0010							
	Roots	.72	.16	1.04	.58	.40									
<i>Andropogon furcatus</i> (bluestem)	Tops	1.05	.17	1.15	.42	.23	.04	.0041							
	Roots	.97	.06	.55	.20	.22									
<i>Silphium laciniatum</i> (rosinweed)	Tops	1.22	.11	1.53	1.20	.60	.02	.0024							
	Roots	2.08	.17	1.43	.50	.26									
<i>Polygonum hydropiper</i> (common smartweed)	Tops	.93	.06	1.90	.60	.73	.01	.0035							
	Roots	.49	.04	1.90	.14	.25									
<i>Polygonum muhlenbergia</i> (swamp smartweed)	Tops	2.08	.17	2.15	.88	.51	.12	.0110							
	Roots	.96	.08	.88	1.16	.39									
<i>Solidago canadensis</i> (common goldenrod)	Tops	.85	.11	.98	1.00	.54	.01	.0015							
	Roots	1.30	.15	.98	.42	.29									
<i>Cirsium lanceolatum</i> (common thistle)	Tops	1.70	.26	1.80	2.06	.68	.10	.0024							
	Roots	2.30	.24	1.63	1.94	.61									
<i>Asclepias syriaca</i> (common milkweed)	Tops	1.52	.24	1.01	1.56	.75	.02	.0022							
	Roots	.85	.15	.65	.60	.50									
<i>Spartina michauxiana</i> (slough grass)	Tops	.78	.16	.91	.23	.15	.01	.0010							
	Roots	.82	.12	.81	.15	.16									
<i>Rumex crispus</i> (yellow dock)	Tops	3.21	.39	2.80	.90	.87	.22	.0088							
	Roots	1.06	.23	1.63	1.18	.73									
<i>Helianthus</i> sp. (wild sunflower)	Tops	1.16	.14	1.70	1.36	.47	.01	.0026							
	Roots	1.60	.30	1.66	.36	.25									
<i>Silphium terebinthinaceum</i> (prairie dock or rosinweed)	Tops	.65	.09	1.25	1.77	.82	.02	.0015							
	Roots	1.90	.20	1.20	.41	.38									

* All samples were collected in the field by Herman Wascher of the Illinois Soil Survey.