PROTEIN PRODUCTION OF A WEED PLANT SOCIETY
A PRODUCTION-BIOLOGICAL STUDY.

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With 1 Figure and 6 Tables in the text.

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The great nutrient value of weeds in respect to nitrogen is known from chemical and physiological investigations of some species (KORSMO, 1930, MORITA, 1936, BAUER, 1938, OLSON and WHITHEAD, 1940, SCHROPP, 1943, etc.), but I can find no data on the production of an entire weed-association. I have therefore determined the KJELDAHL nitrogen of a weed society in the garden of our Institute and expressed it as protein.

The area surveyed had been an ornamental park before the war and was dug up during the war years and made into a kitchen garden. Cabbage had been planted there in the year of our study (1947). In the meantime, because of the construction of the locks in the Sió canal, the water-level of Lake Balaton rose to an unusual height, so that, partly because of sub-soil water, partly because the shore was flooded, the kitchen garden was abandoned. In August the waters of the lake returned to normal level, the kitchen garden also dried out, but in the meantime most of the vegetables had died, or were so stunted that it was no longer worth while bothering with them. By the middle of September a weed plant society had formed on this area, composed as shown in Table I.

According to the data in Table I. this society belongs to *Echinochloa crus galli*-assn, in the *Polygono-Chenopodion group.* Its name is: *Panico-Chenopodietum,* consoc. *Digitaria sanguinalis-Setaria glauca* assn. *(Digitarieto-Setarietum).*

The survey given in Table I. cannot be used for production-biological investigation. I therefore employed a simple but accurate

TABLE I.
Digitaria sanguinalis-Setaria glauca assn.

	1	2	3	4	5	A—D*	Fr*
K—Th Digitaria sanguinalis	5	5	5	5	5	5	5
K—Th Setaria verticillata	2	2	—	—	2	2	3
K—Th S. glauca	2	2—3	3	2	2—3	2—3	5
Cp—G Poa angustifolia	—	—	—	1	—	1	1
K—Th P. annua	—	—	—	1	—	1	1
K—Th Polygonum lapathifolium	—	—	—	1	—	1	1
K—Th P. aviculare	1—2	1	2	2	1	1—2	5
Eua—Th Chenopodium glaucum	—	1	—	—	—	1	1
K—Th Ch. album	2	1	1	1	1	1—(2)	5
Adv—Th Amaranthus retroflexus	—	1	1—2	1	1	1	4
Adv—Th A. adscendens	1	1	1	1—2	1	1	5
K—Th Portulaca oleracea	1	—	1	—	—	1	2
Eu—H Ranunculus sardous	1—2	1	—	1	—	1	3
Adv—TH Brassica oleracea	3	3	2—3	2	2	2—3	5
Eua—Th Medicago lupulina	—	1	—	—	1	1	2
Eua—TH Melilotus officinalis	—	1	—	1	1	1	3
Eua—H Trifolium repens	—	2	—	1	—	1—2	2
Eua—H T. pratense	1	1	1—2	2	1—2	1—2	5
Eua—H Lotus corniculatus	—	—	—	1	—	1	1
Eu—Th Mercurialis annua	—	1	—	—	—	1	1
Adv—TH Daucus carota (hort.)	1	—	—	—	1	1	2
K—Th Anagallis arvensis	—	1	1	1	—	1	3
K—H Calystegia sepium	1	—	1	1	—	1	3
K—H Verbena officinalis	1	1	1	1	1	1	5
Eua—H Lycopus europaeus	1	—	—	—	—	1	1
K—Th Solanum nigrum	1	1	2	1	2	1—2	5
Adv—Th Nicotiana longiflora	1—2	—	—	—	—	1—2	1
Adv—Th Petunia hybrida	1	—	2	—	—	1—2	2
Ke—TH Verbascum phlomoides	—	1	—	—	—	1	1
M—Th Kickxia elatine	—	—	1	1	—	1	2
Eua—H Linaria vulgaris	—	—	1	—	—	1	1
Eua—H Plantago lanceolata	1	1	1	1—2	1	1	5
Eua—H P. major	1	1	1—2	1—2	1	1—(2)	5
Adv—Th Erigeron canadense	1	1	1	1	1	1	5
Eua—Th Bidens tripartita	—	1	—	—	—	1	1
Adv—Th Galinsoga parviflora	2	1	2	1	2	1—2	5
Eua—TH Matricaria inodora	—	—	—	1	—	1	1
Eua—Th Senecio vulgaris	—	1	—	—	1	1	2
Eua—G Cirsium arvense	—	—	—	—	1	1	1
Eua—TH Cichorium intybus	—	1	—	—	—	1	1
Eua—H Taraxacum officinale	1—2	2	1	1	1	1—2	5
Eua—Th Sonchus oleraceus	1	—	1	1	—	1	5
M—Th Crepis setosa	—	1	—	—	—	1	1

* A—D = abundantia—dominantia, Fr = frequentia according to BRAUN—BLANQUET 1928.

method for determining the production: I mowed 5 different squares of 1 meter each, separated the plants according to species, and established their fresh weight and dry content. The results are tabulated (T a b l e II).

TABLE II.

Product of 1 m² of Digitarieto—Setarietum. (Average of 5×1 m²).

	Fresh weight	Dry matter	Dry content	% in 1 m²	
	g	g	%	fresh	dry
Digitaria sanguinalis	2140±164	523.6	24.4	51.5	56.9
Setaria glauca	414±35	118.5	28.6	10.0	12.9
Brassica oleracea	1069±192	122.0	11.4	25.7	13.2
Solanum nigrum	71±23	18.7	26.1	1.73	2.1
Galinsoga parviflora	59±17	15.6	26.5	1.42	1.69
Taraxacum officinale	89±11	21.1	23.6	2.17	2.29
Fragments	145±25	62.0	4.27	3.51	6.76
Setaria verticillata	6.5	2.5	38.5	0.15	0.27
Polygonum aviculare	5.4	1.5	27.8	0.13	0.16
Chenopodium album	30.6	9.3	30.4	0.73	1.01
Amaranthus retroflexus	10.1	3.0	29.7	0.26	0.32
A. adscendens	18.1	3.6	19.9	0.44	0.39
Portulaca oleracea	5.5	0.4	7.3	0.13	0.04
Ranunculus sardous	2.1	0.4	19.1	0.05	0.04
Trifolium pratense	3.0	0.8	26.6	0.07	0.08
Daucus carota (cult)	7.9	1.6	20.2	0.19	0.16
Calystegia sepium	1.8	0.3	16.7	0.04	0.03
Verbena officinalis	1.3	0.3	23.1	0.03	0.03
Petunia hybrida	20.6	4.5	17.3	0.49	0.49
Linaria vulgaris	1.1	0.2	18.2	0.02	0.02
Plantago lanceolata	12.3	2.0	16.5	0.29	0.28
P. major	38.5	7.8	20.3	0.93	0.84
Total:	4154.3	919.7	22.13	100	100

The most interesting result of these measurements from the standpoint of production-biology was what a small rôle, outside of a few dominant species, was played by the many species found there. 6 dominant species gave the principal mass of the production, an average of 96.05%; the other 15 (71.5% of the species) accounted for only 3.95% of the production, which we can consider as negligible.

In F i g u r e 1. we see the frequency curve of the more important species (Du Rietz, 1932). These show that the minimiareal for this society is a 2×2 m square, but it can also be seen that the 6 above-mentioned, quantitatively the most important, are already frequent in

the 1 m² square (Fr. > 75 %). It would be technically difficult to mow a smaller area, and it is not worthwhile taking a larger one as unit, because of the small range and high frequency values of the dominant plants. Because of these considerations I worked with a 1 m square.

The chemical investigations were made by the following method; Samples of the plants from the square under survey were put into a drying glass and killed by a temperature of 120° C maintained for 1

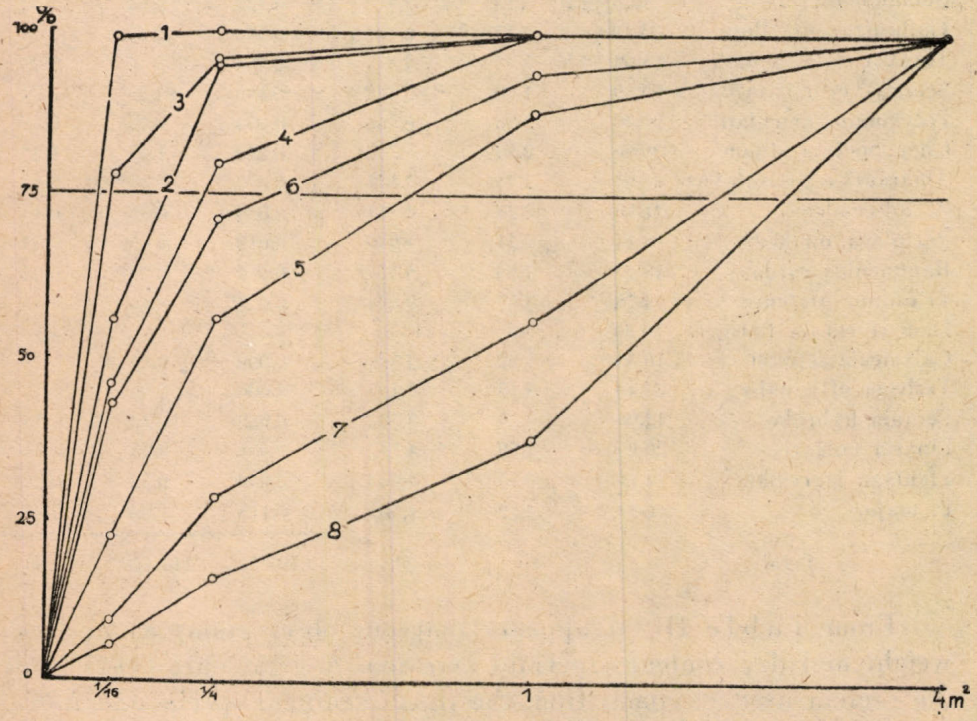

Fig. 1. Frequency-curves of the more important species. 1. *Digitaria sanguinalis*. 2. *Brassica oleracea*, 3. *Setaria glauca*, 4. *Taraxacum officinale*, 5. *Solanum nigrum*, 6. *Galinsoga parviflora*, 7. *Amaranthus adscendens*, 8. *Verbena officinalis*.

hour. They were then dried at 80—100° to constant weight, to establish their dry content. The dry sample, ground to powder, was put in a paper capsule and into an exsiccator filled with $CaCl_2$ until the time of the analysis. The total nitrogen was determined after the KJELDAHL method in a PARNASS—WAGNER apparatus by semi-micro method. Table III. contains the results.

TABLE III.

Nitrogen product of weeds and of the *Digitarieto-Setarietum.*

	Dry content	N% in dry matter	mg N in 1 g fresh matter	gN in 1 m² (average)	g protein in 1 m²	protein % in 1 m²
Digitaria sanguinalis	22.98±1.9	1.80±0.2	4.122±0.8	8.822	55.13	49.40
Setaria glauca	26.26±1.3	1.85±0.1	4.858±0.5	2.014	12.58	10.50
Brassica oleracea	11.67±1.6	4.32±0.1	5.041±0.3	5.390	33.68	29.55
Solanum nigrum	21.66±1.0	2.73±0.8	5.913±0.3	0.423	2.64	2.32
Galinsoga parviflora	25.19±1.9	2.63±0.1	6.624±0.6	0.390	2.43	2.13
Taraxacum officinale	13.09±1.6	3.37±0.7	4.411±0.3	0.395	2.46	2.28
Setaria verticillata	35.89	1.99	7.142	0.046	0.28	0.24
Polygonum aviculare	27.40	2.36	6.466	0.034	0.21	0.18
Chenopodium album	26.86	2.89	7.762	0.232	1.45	1.27
Amaranthus retroflexus	27.91	2.75	7.675	0.077	0.48	0.42
A. adscendens	21.38	2.28	4.874	0.088	0.55	0.48
Portulaca oleracea	8.44	2.31	1.949	0.010	0.06	0.05
Ranunculus sardous	18.25	2.95	5.377	0.011	0.06	0.05
Trifolium pratense	24.78	3.67	9.094	0.027	0.16	0.14
Daucus carota (hort)	20.20	—	—	—	—	—
Calystegia sepium	16.55	3.22	5.329	0.009	0.05	0.05
Verbena officinalis	22.40	3.18	7.123	0.009	0.05	0.05
Petunia hybrida	12.08	2.75	3.322	0.068	0.42	0.36
Linaria vulgaris	20.03	2.39	4.787	0.005	0.03	0.03
Plantago lanceolata	14.66	2.93	4.295	0.052	0.32	0.28
P. major	16.14	2.79	4.503	0.173	1.08	0.95
Total:				18.275	114.12	100.00

From Table III. it appears that our observations as to fresh weight and dry content are valid here too. A great part (89.45%) of the protein product comes from the three dominant species *(Digitaria, Setaria glauca, Brassica).* If we add to these as in Table II. the *Taraxacum, Solanum nigrum* and *Galinsoga,* we see the production to be 96.18%, while the others (70% of the species) produce only 3.82%.

Summing up: On 1 m² the *Digitarieto-Setarietum glaucae* produce an average of 4154.3 g fresh weight of vegetable matter, which comes to 917.7 g dry matter (22%). This produces 114.12 g protein (18.28 g N). 6 dominant species *(Digitaria, Setaria glauca, Brassica, Taraxacum officinale, Solanum nigrum, Galinsoga parviflora)* provide 96% of the production, the rest, 70% of the number of species, take only a very small part, 4%, in the production. In larger production-biological undertakings this small proportion can either be left out of

account or corrected by statistical methods. In production biological surveys the size of the squares can be established by the usual minimiareal method (DU RIETZ, 1932.) and this is always smaller than the floristic minimiareal. These observations relate only to weed plant societies of appearance and content similar to the one investigated. Use of the method in natural plant societies and its perfection, statistical evaluation, etc., are in progress.

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