Hellenic Agricultural Research Institute, Larissa

Grassland's Progress in Greece*

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With 7 figures

I. Introduction

Greece is nowadays traversing a critical transitive phase of development of its agriculture, from the extensive system of cereals production to the more intensive and balanced of the mixed farming — with equivalent as possible agricultural and livestock production — with a larger participation of the enriching leguminous crops and grasses in the valuable utilization of the national soil.

Out of a total acreage of 13.256.000 hectares, the cultivated land is of an acreage of 3.605.485,5 hectares or 27,20%, while the non-cultivated represents $^2/_3$ of the total acreage or 72,80%.

Of the non-cultivated land, the natural permanent pastures, and the alpic ones, are 38,61% (5.118.514,5, hectares), forests and "forest land" 14,77% (1.958.000 hectares), forest pastures 17,15% (2.274.000 hectares), inhabited places 1,51% (200.000 hectares), and the water surface 0,76% (100.000 hectares).

Table 1 gives data of the evolution of the productive differentiation of cultivated land at two different periods of the still predominating seed production system: at 1929 and 1956.

From the table, it is evident that although the area of the cultivated soil increased from 2.251.958,7 hectares (1929) to 3.580.000 hectares (1956) with a reduction of pastures and other tillable soils, which from 1.348.031,3 hectares (1929) are now only 20.000 hectares, still the non exhausting crops, that are represented by leguminous crops, had a rather small increase from 1,48% (1929) to 8,27% (1956) and so the exhausting crops now occupy 90% or more of the cultivated soil: with a participation of cereals of about half (48,49% in 1956) of the total of the cultivated and other productive land.

Table 1. *Evolution of the productive differentiation of the cultivated land, during the period 1929 and 1956 in hectares.*

Use of tillable soil	1929		1956	
	Hectares	%	Hectares	%
I. Cultivated land	2.251.958,7	62,55	3.580.000,0	99,44
1. Annual crops	1.319.413,8	36,65	2.482.873,0	68,97
a) Cereals	1.046.640,2	29,07	1.745.428,7	48,49
b) Leguminous crops	53.269,8	1,48	297.737,2	8,27
c) Industrial crops	142.317,4	3,95	319.707,1	8,88
d) Garden crops	41.785,9	1,16	120.000,0	3,33
e) Fodder crops for hay	35.396,9	0,99	—	—
2. Tree gardens and vineyards	373.059,5	10,36	779.563,6	21,65
3. Fallow	559.485,4	15,54	317.563,4	8,82
II. Non cultivated productive soil and lays	1.348.031,3	37,45	20.000,0	0,56
Total	3.600.000,0	100,00	3.600.000,0	100,00

For the above reasons livestock production is unequally participating in the formation of the national income, giving usually less than 25% of the total mixed agricultural income.

The consumption of foods rich in proteins cannot be served by the local production of livestock products and in 1956 it was necessary to import 40.694 tons of meat, milk, cheese, butter and eggs to the value of 628.826.000 drachmes: or, in other woords: in 1956 15,2% of the consumed meat, 12,4% of the milk, 9,8% of cheese, 36% of the butter and 1,8% of the eggs have been introduced from abroad.

Fig. 1. Development of varieties of lucerne, in the experimental field of Project No. 209. (26/10/55).

Erosion is another problem that is now in full action destroying the productivity of 100.000 hectares of soil per year and reducing the fertility of the soil to a great degree. The result has been the loss of 6.400 hectares of soil yearly, at a depth of 17 cms., and the deterioration of the biotical level of the Greek population. This loss of the soil richness and the continuous diminuation of soil fertility is nationally dangerous, because in Greece "the grain production dominated since ninth century B. C.": and for that "land had been deteriorating progressively under cultivation until grain could no longer be grown at a profit": the result "has been a continuous history of forest removal and soil wastage in Greece from ancient times to the present", because: "the farmers continue to alternate cultivation and fallow, as was done at the time of Pericles 400 years before Christ" (1).

The finding of a solution for that problem was undertaken by the Hellenic Agricultural Research

* This paper is in connection with 2 articles on plant breeding in Greece, already published in this journal (see vol. 11, p. 341—346 and vol. 12, p. 295—298).

Fig. 2. View of experimental field of F. A. O., with annual and perennial legumes and grasses, under dry conditions, at Larissa-Greece. (24/4/56).

Institute, founded in 1933 at Larissa, a town which is situated in the middle of the Thessalian plain and has a mild type of continental climate, with an insufficient average rainfall which amounted to 530,6 mm. per year for the period 1933—1952 (with the exception of 1944—45). Over all the above mentioned, the seasonal distribution of the rainfall does not coincide with the seasonal needs of agricultural and plant vegetation, and a period of frequent hardship for plants is usually observed between March and October, in proportion to the special conditions of each region of the counrty.

Elsewhere (2) meteorological data over an 8 year period (1949 to 1957) are mentioned and a more clear picture is given of the existing unequal distribution of rainfall, especially during the period July-September, when the most intense dry-warm period is dominating, a menace more dangerous for Southern Greece.

The extension of the cultivation of enriching fodder crops has as presupposition the development of the adapted plant types, which could resist the existing climatological conditions in a more suitable way, and so that it could be possible, and advantageous the successful productive use, with progressive substitution of the wheat-monoculture and the successive directing to the grassland agriculture, which will also restore the structure of the land. —

2. Breeding work of Legumes and Grasses

For this purpose the Institute has collected an extensive number of 4.796 plant types (from 28 of February, 1933 till 31 of August, 1960) of which 2.755 belong to leguminous plant varieties from about 40 different species; and 2.011 belong to varieties of grasses from 50 or more different species, and other 30 varieties belong to 3 other species of non-grasses.

Especially, among the leguminous plant varieties there were from the annual and perennial species that are only used for hay production or in pastures the species: *Trifolium sp.* (84), *Trif. subterraneum* (65), *Trif. incarnatum* (35), *Trif. Alexandrinum* (33), *Lespedeza sp.* (22), *Trif. squarrosum* (10), *Scorpiurus sp.* (8), *Anthylis sp.* (7), *Ornithopus sp.* (7), *Trif. hirtum* (6), *Crotolaria* (5), *Trif. glomeratum* (4), *Tetragonolobus sp.* (3), *Sesbania sp.* (2), *Psoralea sp.* (4), *Trif. pratense* (104), *Medicago sp.* (465), *Lotus sp.* (75), *Trif. repens* (67), *Onobrychis sp.* (47), *Hedysarum sp.* (36), *Trif. fragiferum* (26), *Trif. hybridum* (15), *Melilotus sp.* (108).

From the leguminous species that are also adequate for mixed hay and seed production: *Pisum sp.* (402), *Vicia sp.* (315), *Lathyrus sp.* (130), *Lupinus sp.* (85), *Ervum ervilia* (66), *Trigonella sp.* (21), *Glycine max* (453), are included.

Among the grasses there were the following:

a) Annual: *Avena sativa* (97), *Hordeum sp.* (94), *Panicum sp.* (67), *Cenchrus sp.* (23), *Avena sp.* (21),

Table 2. *Seeds distributed by the Hellenic Agricultural Research Institute, for different purposes,* during *the period 1950—1960, procured from many sources.*

No.	Species	Quantities distributed in kg., for				
		experimental purposes	demonstration purposes	seed production	other uses	total
1.	*Melilotus annuus*	239	7.556	910	1.716	10.421
2.	*Melilotus alba biennis*	212	7.544	400	881	9.037
3.	*Melilotus officinalis*	233	2.427	1.260	520	4.440
4.	*Lespedeza sericea*	265	332	273	863	1.733
5.	*Lespedeza kobe*	95	439	260	864	1.658
6.	*Lespedeza korean*	402	225	257	805	1.689
7.	*Trif. incarnatum*	270	2.809	1.680	14.713	19.472
8.	*Trif. Alexandrinum*	504	1.372	1.097	11.610	14.583
9.	*Trif. subterraneum*	394	12.238	2.231	2.198	17.061
10.	*Trif. pratense*	165	3.726		667	4.558
11.	*Trif. repens*	279	1.903	20	286	2.488
12.	*Lotus corniculatus*	174	7.622	870	836	9.502
13.	*Onobrychis persica*	270	4.678	1.311	3.203	9.462
14.	*Hedysarum coronarium*	164	4.015		573	4.752
15.	*Medicago sativa*	2.105	10.597	46.673	5.787	65.162
16.	*Sesbania macrocarpa*	237	2.087		1.850	4.174
17.	*Lolium italicum*	264	8.724	1.291	3.492	13.771
18.	*Lolium perenne*	265	14.201	1.871	2.575	18.912
19.	*Bromus marginatus*	192	1.374	365	26	1.957
20.	*Bromus inermis*	113	5.032	1.588	318	7.051
21.	*Phalaris canariensis*	399	2.467	2.839	121	5.826
22.	*Phalaris tuberosa*	234	2.353	1.401	149	4.137
23.	*Phalaris arundinacea*	253	1.189	294	132	1.868
24.	*Agrostis alba*	283	185		281	749
25.	*Agropyron cristatum*	315	1.481	398	378	2.572
26.	*Bouteloua curtipendula*	115	337	400	8	860
27.	*Dactylis glomerata*	227	1.835	717	158	2.937
28.	*Eragrostis curvula*	175	166	361	71	773
29.	*Festuca arundinacea*	403	3.724	70	326	4.523
30.	*Phleum pratense*	77	3.858	778	3.488	8.201
31.	*Paspalum dilatatum*	230	466	124	20	840
32.	*Poa pratensis*	279	167		1.396	1.842
33.	*Poterium sanguisorbe*	370	5.691	503	431	6.995
34.	*Chloris gayana*	26	302		171	499
35.	*Other species*	920	3.711	294	8.005	12.930
	Total	11.148	126.833	70.536	68.918	277.435

Chloris sp. (15), *Aegilops sp.* (14), *Alopecurus sp.* (8), *Secale sp.* (8), *Aira sp.* (3), *Echinochloa sp.* (1).

b) Perennial: *Festuca sp.* (135), *Bromus sp.* (121), *Agropyron sp.* (97), *Dactylis sp.* (97), *Poa sp.* (51), *Oryzopsis sp.* (49), *Eragrostis sp.* (36), *Phleum sp.* (36), *Andropogon sp.* (25), *Agrostis sp.* (22), *Ehrharta sp.* (22), *Arrhenatherum sp.* (19), *Paspalum sp.* (19), *Cynodon sp.* (18), *Digitaria sp.* (11), *Elymus sp.* (9), *Bothriochloa sp.* (3), *Bouteloua sp.* (1).

Among the different non-grasses there were: *Poterium sp.* (12), and *Helianthus tuberosus* (16).

The comparative cultivation of the above plant types took place at Larissa and at other places in the most important regions of the country so that preliminary observation of the most important of them be possible for the principal regions of Greece.

For this purpose, and with the basis of the preliminary results from the Institute, received up to then which are partially referred to elsewhere (3), seeds have been introduced during the period 1950—1960 of 277.435 kilo for a further experimental demonstration and other uses in seed production.

Table 2 gives data about the distribution of the quantities and the main species and the principal purposes for which those seeds were used.

The above mentioned research network, during the period 1950—1960, had the following classes of trials:

1. Trials for varieties of lucerne 89
2. Demonstration fields for lucerne 364
3. Demonstration fields for *Melilotus* 96
4. Demonstration fields for fertilization and management of pastures 15
5. Demonstration fields for pasture improvement 154
6. Trial fields for mountainous forest pastures 58
7. Demonstration fields for different other purposes 307

Especially from the above total trials and demonstration fields of 1083, 102 had been established in Crete and the other islands of Greece; 72 in Peloponnesus, 138 in Main Greece, in Thessaly 193, 121 in Epirus, in Macedonia 391, and in Thrace 66.

In addition to the above mentioned, it was possible, with those seeds, for a reseeding of 1.639,7 hectares of pastures to be made, which 289,8 in Macedonia, 177,8 in Epirus, 833,4 in Thessalia, 68,4 in Thrace, 112,3 in Continental Greece, 136 in Peloponnesus and 22 in the islands, for the period 1952—53, to 1959—60. —

Besides them the Institute was intrusted with the work of the participation of Greece in the international trials of fodder crops, made under the supervision of O.E.E.C. This work was known under the Project Numbers 209, 210 and 215. According to them, the Institute has established;

1. 2 trials on lucerne at Larissa, for the Project No. 209 (4)
2. 2 trials of *Lolium perenne* at Larissa (4) and (6)
3. 2 trials for *Trifolium pratense* at Jannina, for the Project 210 (4) and (6)
4. one trial at Larissa, for Project 215 (5/41), concerned, with the postcontrol of the seeds produced from forage crops.

Table 3. *Average yields in dry matter of seed and straw, of different rotations, during the ten-year period 1950—1959, in kilo per hectare.*

No.	Biennial Rotations		Dry Matter of Seed			Dry Matter of Straw			Dry Matter of Seed and Straw		
	1st year	2nd year	1st year	2nd year	Total average of 2 year rotations	1st year	2nd year	Total average of 2 year rotations	1st year	2nd year	Total average of 2 year rotations
1.	Wheat —	Wheat	934,0	934,0	1868,0	1863,0	1863,0	3726,0	2797,0	2797,0	5594,0
2.	Uncultivated Fallow —	Wheat	—	1588,0	1588,0	—	2958,0	2958,0	—	4546,0	4546,0
3.	Cultivated Fallow —	Wheat	—	1717,0	1717,0	—	3345,0	3345,0	—	5062,0	5062,0
4.	Peas —	Wheat	445,0	1593,0	2038,0	945,0	2972,0	3917,0	1390,0	4565,0	5955,0
5.	Broad-bean—	Wheat	1020,0	1702,0	2722,0	1090,0	3244,0	4334,0	2110,0	4946,0	7056,0
6.	Crimson cl.	Wheat	—	1640,0	1640,0	—	2889,0	2889,0	—	4529,0	4529,0
7.	Vetch —	Wheat	963,0	1795,0	2758,0	1688,0	3309,0	4997,0	2651,0	5104,0	7755,0
8.	Green manur. —	Wheat	—	1818,0	1818,0	—	3444,0	3444,0	—	5262,0	5262,0
9.	Grass-pea —	Wheat	1365,0	1584,0	2949,0	1380,0	2947,0	4327,0	2745,0	4531,0	7276,0
10.	Lentil —	Wheat	813,0	1636,0	2449,0	1559,0	3043,0	4602,0	2372,0	4679,0	7051,0

The research verified the value of the cultivation of annual and biennial clovers, and, especially, of *Trifolium Alexandrinum* (Berseem clover), in the south and warm part of Greece, under irrigation, of *Trifolium hirtum* (Rose-clover), under dry conditions, of *Trifolium incarnatum* (Crimson-clover), in the plains of northern Greece; and of *Trifolium pratense* (Red-clover) in the cool plateaus of the whole country. Lucerne is a valuable crop with the varieties U.S.D.A. African for the southern Greece, Hungarian for the alcaline soils, and Talent for the principal lucerne belt, in pure stands, or in mixture, with other crops and especially, with Birds-foot trefoil (*Lotus corniculatus*) from the leguminous; and from grasses: harding grass (*Phalaris tuberosa*), cocksfoot (*Dactylis glomerata*), fescue (*Festuca arundinacea*); and the bulbous barley grass (*Hordeum bulbosum*) for the more dry and level soils of low productivity, where

Fig. 3. Project No. 210. Harvesting of the spaced plants of *Lolium perenne*. (25/5/56).

Table 4. *Average yields of dry matter of some principal varieties of legumes and grasses, grown purely and mixed, totally and percent of each component and of wheat following the second year of the rotation, during the 3 year period 1957—1959 (crops years), in kilo per hectare, without any fertilization.*

No.	Pure or Mixed culture of legumes and grasses	Average yields of Hay Dry matter 1957—59 Total mixture	Percentage of the total mixture 1st component %	2nd component %	3rd component %	4th component %	5 th component %	Average yields in dry matter of seed of wheat of the 3 years per. 1957—1959	Average total of dry matter of seed and straw, of wheat kg./hectare
1.	Natural vegetation	2713,2						1590,3	4624,8
2.	Grass-pea (L-92)	3009,0						1717,2	5135,9
3.	Vetch (Bi-64)	2177,7						1508,4	4559,0
4.	Bitter vetch (O-4)	2459,0						1768,5	5017,2
5.	Lentil (F-1)	1968,6						1719,0	5017,0
6.	Lupin (Lp-1)	2245,7						1887,3	5389,3
7.	Barley (M-4427)	3377,9						1361,7	3555,5
8.	Oats (M-4428)	4670,7						1213,2	3273,6
9.	*Triticum monococcum* (M-3457)	4530,5						1158,3	3069,1
10.	Rye	2918,0						1546,2	4560,3
11.	Wheat (38290)	3686,4						1445,4	3936,7
12.	Grass-pea + *Trit. mon.*	3489,2	39,2	60,8				1470,6	4012,1
13.	Grass-pea + Barley	3648,2	37,9	62,1				1421,1	3903,9
14.	Grass-pea + Oats	3451,0	34,8	65,2				1366,2	3788,7
15.	Grass-pea + Rye	3257,2	49,0	51,0				1533,6	4360,7
16.	Vetch + Wheat	2384,2	72,3	27,7				1534,5	3817,6
17.	Vetch + *Trit. monoc.*	3272,5	55,0	45,0				1438,2	4006,9
18.	Vetch + Lentil	2266,9	70,5	29,5				1498,5	4255,9
19.	Barley + Oats + Vetch	3326,9	34,0	42,4	23,6			1324,8	3818,7
20.	Barley + Oats + Rye	3581,9	33,3	43,9	22,8			1389,6	4175,0
21.	(1)Barley (2)Oats (3)Rye (4)Wheat	3461,2	28,7	38,3	18,9	14,1		1285,2	3710,2
22.	(1)Barley (2)Oats (3)Vetch (4)Rye (5)Wheat	3288,6	24,0	31,3	18,1	14,6	12,0	1329,3	3711,0
23.	50% Berseem clover + 50% Oats	3893,8	8,6	91,4				1302,3	3559,0
24.	50% Crimson clover + 50% Oats	3621,8	19,4	80,6				1336,5	3668,9

it can give better yields in quantity and of higher quality from the native flora; from other species as well as burnet (*Poterium sanguisorbe*) with its incomparable adaptability.

Research also found the value of more adapted varieties of annual leguminous crops as: vetch (*Vicia sativa*), with its productive varieties: Bi-45, Bi-64, Bi-65 and Bi-72, grass-pea (*Lathyrus cicera*), with its varieties: L-92 and L-121, bittervetch (*Ervum ervilia* or *Vicia ervilia*), with its variety O-4, peas (*Pisum arvense*) with its varieties K-22 and K-129 and soybeans (*Glycine max*), with its varieties: Harosoy, Lincoln, and Ogden, which can be used for the production of green food, hay, and seed, and can multiply not only the proteins produced by the soil, but also the other useful nutritious elements, for a further basic improvement of the livestock.

Indeed, the new strains of annual legumes, with greater adaptability help, considerably, the establishment of balanced rotations, which improve the soil and greatly increase the output of the farmers in the same area and the same time.

Fig. 4. Berseem clover at flowering stage, in Istiea-Evia, between apple trees.

These strains also can be used in pure or mixed culture to produce — in ley-farming — more food of better quality, particularly in respect of the protein content, comparatively, with the poor and lower palatability native vegetation, with reciprocal improvement of the fertility of the soil, for better yields

Table 5. *Comparative yields in dry matter, of different agricultural forage plants with phosphoric acid fertilization (40 units P_2O_5/hectare) at Volax-Rhodopis, altitude of 950 m. of Macedonia during the 4 year period 1952—1955, in kg. per hectare.*

No.	Forage plants	Average yields in kilo per hectare
1.	*Onobrychis persica*	6018,0
2.	*Medicago sativa*, Canadian	5887,9
3.	*Trifolium pratense*	5539,4
4.	*Melilotus officinalis*	5288,7
5.	*Lotus corniculatus*	5196,0
6.	*Melilotus annuus*	4853,5
7.	*Trifolium repens*	4805,0
8.	*Hedysarum coronarium*	4706,4
9.	*Poterium sanguisorbe*	4556,0
10.	*Medicago sativa*, Ladak	4289,9
11.	*Dactylis glomerata*	4153,1
12.	*Melilotus alba biennis*	4040,9
13.	*Lespedeza sericea*	4012,0
14.	*Medicago sativa*, Grimm	3852,2
15.	*Eragrostis curvula*	3791,0
16.	*Lolium perenne*	3615,0
17.	*Agropyrum cristatum*	3547,0
18.	*Phleum pratense*	3414,4
19.	*Lolium multiflorum*	3213,0
20.	*Bromus inermis*	3122,0
21.	*Festuca arundinacea*	3054,0
22.	*Phalaris tuberosa*	2924,0
23.	*Trifolium subterraneum*	2871,3
24.	Natural vegetation	2441,2

from the food and cashcrops also. Table 4 gives reciprocal data. The use of P_2O_5 increases the yields both of the legumes and the depleting plants of the rotation.

Also, the utilization of adequate strains of perennial legumes and grasses, insures better and higher yields of pasture and hay in the hill areas, which occupied a very great surface in Greece.

Table 5 gives some experimental data for the ecological conditions of Macedonia.

The productivity of the agricultural fodder plants also makes necessary the production of enough seeds for an adequate and economical substitution of the natural pastures.

The above produced seeds, with supplementary ones introduced from abroad, contributed to the significant development of the legumes for hay — and seed or mixed purposes; so that their participation in the total cultivated area has been increased with a corresponding improvement in the balance of nitrogen, in the soil and of the food, and feed production, used advantageously from more productive livestock.

Especially: a) The vetch from a few thousand hectares occupied (1960) 100.000 hectares and more, b) The forage-pea, an unknown crop in the pre-war period, has been extended to 25.000 hectares, localized in the hill and mountainous area of NW Greece, c) The Berseem clover, from O hectares (1952), reached to 3.000 hectares and more, d) The Crimson clover, from a few hectares, reached 1.000 hectares and more: proportionally, had been increased and the other annual legumes. Also, e) Lucerne, from 13.260 hectares (1937), had been developed to 60.000 hectares (1960) and so on.

The results of the research work of the Hellenic Agricultural Research Institute were the basis for the gradual development of the cultivation of the enriching leguminous crops in such a way, that the acreage of the land cultivated with them was to be increased from 50.000 hectares at the end of the third ten-years of this century, to 300.000 hectares by 1958, and with a further increase of 42.500 hectares, for the year 1959—1960; and so the percentage of the participation of those crops to the total cultivated acreage was to be increased from 1,5% about (1929) to 12% (1960). Also, the qualitative increase of the livestock production due to the above mentioned improvement of legumes, can be estimated, in comparison with the pre-war production, to 12,2% and this is due to possibilities created by serving the livestock with condensed foods rich in proteins.

Indeed, although the year 1938 saw a total mixed agricultural income of 28.705.696.002 drachmas, livestock production participated with 19,16% and agricultural production with 80,84%: in the year 1956, with a mixed income of 26.457.886.006,5 drachmas livestock production represented 23,62% and agricultural production 76,38%; and so it is evident that we had not only a qualitative increase, but also an increase of the mixed income of the livestock production to a percentage of 18,88%.

The introduction and the development of more productive types, led to the improvement of the fertility level of the soil, and the increase of the productivity of soils cultivated with them. Also, it led to successfull differentiation of the production to cultures-crops that are giving a higher income; and also, to the improvement of the feeding level of the livestock;

Table 6. *Seed-production of legumes and grasses during the 10 year period 1951—1960, done by State Seed Centers and Public Estates under the control of the Hellenic Agricultural Research Institute and the supervision of the Ministry of Agriculture.*

No.	Species of Plants	Distributed quantities for demonstration purposes and seed production, during the 10 years period 1951—1960	Produced seeds, during the 7 years period of 1954—1960, in kilo	Area for active seed production, growing during the year 1960 (30/9/60), in hectares
	a) Legumes			
1.	*Trifolium Alexandrinum*	28818	228869	0,5
2.	*Trifolium subterraneum*	4686	877	1,6
3.	*Trifolium incarnatum*	2875	2252	1,0
4.	*Melilotus annuus*	2858	536	—
5.	*Trifolium resupinatum*	160	4310	11,0
6.	*Trifolium hirtum*	5	449	0,6
7.	*Melilotus alba biennis*	2684	248	—
8.	*Trifolium pratense*	1772	3598	19,8
9.	*Melilotus officinalis*	1339	118	0,1
10.	*Medicago sativa*	164410	427378	1535,2
11.	*Onobrychis sativa*	1951	1358	4,5
12.	*Lotus corniculatus*	1139	1702	4,1
13.	*Trifolium repens*	883	353	10,0
14.	*Hedysarum coronarium*	591	—	—
15.	*Lespedeza sericea*	322	—	—
16.	*Lespedeza kobe*	260	—	—
17.	*Lespedeza korean*	257	—	—
18.	*Trifolium fragiferum*	101	1939	6,4
	b) Grasses			
19.	*Phalaris canariensis*	3005	4901	—
20.	*Lolium italicum*	1953	5357	3,5
21.	*Lolium rigidum*	5	10	0,5
22.	*Lolium perenne*	6759	1168	3,7
23.	*Bromus inermis*	3672	—	0,3
24.	*Phalaris tuberosa*	1484	528	3,0
25.	*Dactylis glomerata*	821	1862	6,2
26.	*Phleum pratense*	786	7	0,2
27.	*Bromus marginatus*	645	—	—
28.	*Festuca arundinacea*	487	2341	5,4
29.	*Agropyron cristatum*	436	—	0,3
30.	*Bouteloua curtipendula*	400	—	—
31.	*Eragrostis curvula*	384	—	—
32.	*Paspalum dilatatum*	305	—	—
33.	*Phalaris arundinacea*	294	—	—
34.	*Andropogon scoparius*	294	—	—
35.	*Sporobolus auroides*	270	—	—
36.	*Chloris gayana*	204	—	—
37.	*Oryzopsis miliacea*	24	1771	1,3
38.	*Hordeum bulbosum*	5	110	0,2
	c) Other species			
39.	*Poterium sanguisorbe*	887	8853	4,1
		238231	700895	1623,5

to the protection of the soil from the erosional act of the winter — especially — rainfalls, to the absorbing of larger quantities of water increase the subsoil stocks of water, and in general, to the standardization of agricultural system in such a way, as to bring about in proportion, a higher and better production with lower costs.

Besides, there has been an increase in the nitrogen taken by leguminous crops from the air, which is improving the soil fertility and replacing the equivalent of nitrogen fertilizers that are imported from abroad, so that the products of the produced crops have a lower cost.

Fig. 5. Growth of *Trifolium hirtum* under autumn sowing in dry conditions, at Larissa-Greece. (10/5/55.)

3. Experimental Data

Here we are intended to give some representative experimental data, that can be connected with a scientific and reasonable soil exploitation, avoiding soil exhaustion and inaugurating salubrious soil conservation.

1. Regarding the productivity of the more representative legumes, grasses and other crops, under the climatic conditions of Larissa. Table 7 provides data.

From this table it is evident: a) that the substitution of the native flora creates possibilities for the better utilization of the soil and b) over that by the cultivation of legumes the soil fertility is increased and standardized and the producer can take higher yields from the succeeding crops, which will have in surplus the possibility to use the nitrogen of the air to a great extent, for fulfilling their needs.

2. Regarding the existing differentiation, between different varieties of lucerne, under dry condition and irrigation, tables No. 8 and No. 9, provide summarized data as elsewhere is mentioned (4).

It is evident that the use of more appropriate lucerne varieties, adapted to the ecological conditions of each region, has a decisive importance in the lucerne cultivation.

From these data it is evident, that the average yields was between 944 (D'Harmign.) and 1832 kgs. per hectare in the different varieties (table 8), in the trial under dry conditions, and between 3120 (D'Harmign.) and 5754 kg. (Marchigiana), in the trial field under irrigation (table 9). It is evident that Marchigiana has in this experimental cycle the higher adaptability in the especially compact soil of Larissa. The irrigation of lucerne is very efficient for the increase of its yields and the decrease of its cost of production.

3. Concerning the possibilities of the cultivation of lucerne in mixtures, with grasses with sowing in the same row, or in alternative rows, the trial showed that in dry conditions at Larissa, sowing in alternative rows is usually preferable because then the competition of the plants during the first stage of their development is milder.

4. Regarding the fertilization of lucerne with P_2O_5 it was shown, that the phosphatic fertilization is of basic importance, and can increase the yield to more than two times and reduce the production cost considerably, as elsewhere was mentioned (5).

5. Regarding the fertilization with nitrogen and phosphoric acid of leguminous crops and grasses, data are given for a three year period (table 12).

From this table it is evident, that for the grasses the nitrogen is of almost equal importance with the P_2O_5 in increasing the yields. For the legumes on the other hand, it decreases the yields, because it weakens the symbiotic relations with the root nodules bacteria, while P_2O_5 increases the yields significantly by lowering also the cost of the hay production.

Consequently, the trial shows that the phosphorus when it is added to a leguminous crop cultivation, creates optimum conditions for the increase of the yield and for the improvement of the texture of the

Table 7. *Average yields in dry hay of different species of grasses and leguminous crops, at Larissa, during the 6 year period 1952—1958, under irrigation.*

Date of sowing 19—21/3/53.

No.	Species and varieties	Average yields of dry hay kg. per hectare	Density		Number of cuts						Height of the 1st cut, cms					
			1953	1958	1953	1954	1955	1956	1957	1958	1953	1954	1955	1956	1957	1958
1.	Native flora	1416	—	—	2	2	1	1	3	1	85	—	—	67	30	—
2.	*Lolium perenne*	1095	4,8	0,8	2	2	1	1	3	1	32	—	60	65	60	55
3.	*Agropyr. cristatum*	1125	4,5	1,5	1	2	1	—	2	—	28	—	32	—	35	—
4.	*Bromus inermis*	1138	4,7	4,0	2	2	2	2	1	1	38	—	55	27	75	40
5.	*Lotus corniculatus*	1863	4,0	0,5	3	3	3	3	3	2	38	—	22	24	30	24
6.	Lucerne Altfränkische	3150	4,7	0,1	3	5	4	3	5	4	40	—	40	28	20	25
7.	*Phalaris tuberosa*	3469	4,5	4,5	1	3	3	2	3	1	45	—	40	32	30	60
8.	*Festuca arundinacea*	3761	4,7	4,6	2	1	4	2	3	2	35	—	36	49	40	47
9.	*Onobrychis persica*	4639	4,7	2,5	1	2	2	3	4	2	32	—	85	50	50	60
10.	Lucerne U.S.D.A. African	5415	4,8	2,0	3	6	7	4	5	4	35	—	45	35	45	35
11.	*Poterium sanguisorbe*	6183	4,5	4,3	1	2	3	2	3	2	35	—	28	42	25	40
12.	*Eragrostis curvula*	9487	4,0	4,5	2	3	5	3	4	4	100	—	28	37	40	60

Table 8. *Average yields of dry hay, in kg. per hectare, of different varieties of lucerne, at Larissa, during the 5 year period 1953—59, under dry conditions, without P_2O_5 fertilization.*

Date of sowing 9 and 21/4/55.

No.	Varieties	Average yields of dry hay kg. per hectare	Density		Number of cuts					Height of the 1st cut, cms.				
			1955	1959	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959
1.	Local variety of Lamia	1291	4,5	0,3	2	3	4	3	3	27	48	27	43	50
2.	Atlantic	1108	4,6	0,3	2	3	4	3	3	26	43	27	30	51
3.	Marchigiana	**1832**	4,2	0,9	2	3	4	3	3	27	53	33	44	54
4.	Du Poitou	**1797**	4,2	0,7	2	3	4	3	3	27	57	34	44	53
5.	D'Harmignies	944	1,7	0,2	2	3	4	3	3	31	47	26	32	47
6.	De Kayseri	1195	4,4	0,1	2	3	4	3	3	30	45	29	39	50
7.	Caliverde	1176	4,6	0,2	2	3	4	3	3	28	46	32	38	50
8.	Flamande	1110	4,3	0,3	2	3	4	3	3	27	50	27	39	54
9.	D'Autriche	1322	4,1	0,3	2	3	4	3	3	27	44	29	32	45
10.	Du Puits	1188	4,3	0,3	2	3	4	3	3	28	50	30	39	46
11.	Altfränkische	1350	4,3	0,5	2	3	4	3	3	27	46	27	36	44

Density has been graduated with 5,0 for the best and 0,0 for the worst.

Table 9. *Average yields of dry hay, in kg. per hectare, of different varieties of lucerne, at Larissa, during the 5 year period 1954—1959, under irrigated conditions, and with 5 replications each, without P_2O_5 fertiliziation.*

Date of sowing 11/4/55.

No.	Varieties	Average yields of dry hay kg. per hectare	Density		Number of cuts					Height of the 1st cut, cms.				
			1955	1959	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959
1.	Local variety of Lamia	4688	4,7	3,3	3	4	5	4	3	39	56	33	39	48
2.	Atlantic	4764	4,7	4,5	3	4	5	4	3	37	48	31	39	45
3.	Marchigiana	5754	4,6	4,3	3	4	5	4	3	38	55	40	41	47
4.	Du Poitou	4919	4,5	4,5	3	4	5	4	3	37	49	27	38	48
5.	D'Harmignies	3120	2,7	3,0	3	4	5	4	3	37	69	28	28	39
6.	De Kayseri	5310	4,7	4,0	3	4	5	4	3	40	50	34	38	46
7.	Caliverde M-4734	5106	4,8	4,3	3	4	5	4	3	37	48	38	42	50
8.	Altfränkische	4498	4,6	4,4	3	4	5	4	3	35	45	27	32	35
9.	Flamande	3986	4,4	3,7	3	4	5	4	3	37	46	30	30	38
10.	D'Autriche	4506	4,5	4,4	3	4	5	4	3	37	48	34	34	42
11.	Du Puits	4633	4,5	4,1	3	4	5	4	3	37	49	34	35	45

Density has been graduated with 5,0 for the best and 0,0 for the worst.

Table 10. *Average yields of dry hay, in kg per hectare, of different varieties of luzerne with Phalaris tuberosa, at Larissa, during the 5 year period 1954—1959. Cultivation under dry conditions, without fertilization.*

No.	Varieties	Average yields of dry hay kgs. per hectare	Percentage of lucerne in the mixture					Density		Number of cuts				
			1955	1956	1957	1958	1959	1955	1959	1955	1956	1957	1958	1959
1.	Du Puits + *Phal.tub.*	1998	77,4	43,7	53,0	61,8	58,5	4,6	0,8	2	3	4	3	3
2.	Marchig. + *Phal.tub.*	2173	84,6	57,5	75,4	71,8	82,5	4,5	0,6	2	3	4	3	3
3.	De Kayseri + *Phal.tub.*	1815	76,1	38,0	52,8	57,4	70,2	4,7	0,3	2	3	4	3	3
4.	Caliverde + *Phal.tub.*	1852	73,2	44,0	50,0	58,7	65,7	4,6	0,6	2	3	4	3	3
5.	Talent + *Phal.tub.*	1776	74,4	53,6	58,5	64,3	64,9	4,5	0,7	2	3	4	3	3
6.	Talent + *Phal.tub.*	1979	66,6	43,3	63,8	73,6	72,6	4,4	0,6	2	3	4	3	3

Density has been graduated with 5,0 for the best and 0,0 for the worst.

* 1—5 sowing in the same row. — 6 sown in alternative rows.

Table 11. *Average yields of dry hay, in kg. per hectare, of the lucerne, variety Talent, at Larissa, during the 4 year period 1956—1960, with and without phosphoric fertilization.*

Date of sowing 10/11/1956.

No.	Cultivation under Conditions	Fertilization	Yields of Dry Hay kg./hect.					± % in Comparison with the check	Numb. of cuts				Height of the 1st cut in cms.			
			1957	1958	1959	1960	Average		1957	1958	1959	1960	1957	1958	1959	1960
1.	Non irrigated	—	2152	1852	2191	1345	1885	±0	3	4	5	3	42	32	47	34
2.	Non irrigated	P_2O_5	3056	5251	4314	6669	4822	155,81	3	4	5	3	40	46	51	59
3.	Irrigated	—	4209	4156	3207	1464	3259	±0	3	4	5	3	45	35	51	39
4.	Irrigated	P_2O_5	5720	9059	7764	8004	7637	134,34	3	4	5	3	45	52	60	62

P_2O_5 fertilization = 60 kgs. of P_2O_5 per hectare, yearly.

Table 12. *Average yields of dry hay, in kg. per hectare, of different species of grasses and legumes, under different nitrogen and phosphoric fertilization, at Larissa, during the 3 year period, 1956—1959, cultivation under irrigation.*

Date of sowing 10/11/1956.

No.	Species and variety	Fertilization	Yields of Dry Hay kg. per hectare				± % in Comparison with the check	Numb. of cuts			Density		Height of the lst cut in cms.		
			1957	1958	1959	Average		1957	1958	1959	1957	1959	1957	1958	1959
1.	Native flora	—	3022	428	1320	1590	±0	4	1	2		3,4	20		
2.	Native flora	N	4162	795	1155	2037	28,11	4	1	2		3,6	27		
3.	Native flora	P	5888	955	842	2562	61,13	4	1	2		3,2	52		
4.	Native flora	N+P	6617	1490	1942	3350	110,69	4	1	2		4,0	55		
5.	*Onobrychis persica*	—	2888	7112	3150	4383	±0	3	2	2	3,9	2,2	35	77	78
5.	*Onobrychis persica*	N	3513	7197	3120	4610	5,18	3	2	2	4,2	2,4	48	70	80
7.	*Onobrychis persica*	P	5283	10708	2880	6290	43,51	4	2	2	4,1	2,7	40	82	83
8.	*Lucerne Talent*	—	3267	3013	2242	2841	±0	3	3	3	4,1	2,7	28	28	57
9.	*Lucerne Talent*	N	2213	2213	1850	2092	—33,40	3	3	3	4,2	2,8	27	24	57
10.	*Lucerne Talent*	P	5745	7155	3958	5619	97,78	3	3	3	4,6	3,4	35	53	58
11.	*Lotus corniculatus*	—	1967	1270	988	1408	±0	3	2	2	4,0	2,9	25	23	20
12.	*Lotus corniculatus*	N	2100	1108	850	1353	—3,91	3	2	2	4,1	3,1	27	19	25
13.	*Lotus corniculatus*	P	3247	4553	2670	3490	147,86	3	2	2	4,1	3,7	28	38	40
14.	*Phalaris tuberosa*	—	2595	2550	1892	2346	±0	3	1	1	3,9	3,7	62	47	90
14.	*Phalaris tuberosa*	N	2970	2478	2725	2724	16,11	3	1	1	4,2	4,3	63	57	95
16.	*Phalaris tuberosa*	P	3820	2688	2947	3152	34,36	3	1	1	4,3	4,3	67	57	92
17.	*Lolium perenne*	—	863	897	272	677	±0	3	1	1	1,6	0,8	57	48	58
18.	*Lolium perenne*	N	888	1588	287	921	36,04	3	1	1	1,5	0,6	60	53	62
19.	*Lolium perenne*	P	2595	1053	592	1413	108,71	3	1	1	2,7	0,4	67	42	63
20.	*Festuca arundinacea*	—	2462	1480	970	1637	±0	3	2	1	4,2	4,4	77	24	95
21.	*Festuca arundinacea*	N	3695	2588	1530	2604	59,07	3	2	1	4,3	4,5	77	28	98
22.	*Festuca arundinacea*	P	4917	2155	1170	2747	67,81	3	2	1	4,6	4,5	80	31	98
23.	*Poterium sanguisorbe*	—	3205	3138	2310	2884	±0	2	2	2	4,5	4,5	40	33	70
24.	*Poterium sanguisorbe*	N	3530	4067	2763	3453	19,73	2	2	2	4,6	4,8	45	29	73
25.	*Poterium sanguisorbe*	P	3538	4087	2880	3502	21,43	2	2	2	4,3	4,7	43	36	77

N = Fertilization with 40 units of N (20,5—0—0) per hectare
P = Fertilization with 60 units of P_2O_5 (0—16—0) per hectare
N+P = Fertilization with 40 units of N (20,5—0—0) per hectare + 60 units of P_2O_5 (0—16—0).

soil, by synthetising organic matter that remains in the soil and which increases the productivity and its biochemical potentialities.

6. Regarding the adaptation of different varieties of *Trifolium pratense,* at Jannina-Epirus-North-West Greece, data also are given and specially:

a) With cultivation of spaced plants, as this is mentioned comparatively, with the results of other trials centers, elsewhere (4), for the years 1956 and 1957. There a great differentiation could be seen under the favourable climatic conditions of Jannina, between the different varieties, in respect of the average stem length and the plant mortality. The differences between the varieties are significant and essential and influence in a great degree the economical use of *Trifolium pratense.*

Fig. 6. Cultivation of a mixture of *Phalaris tuberosa* and *Trifolium subterraneum* with phosphoric fertilization, at Larissa, in alternative rows.

b) Concerning the productivity of 22 different varieties with cultivation under the same climatic conditions, over a 4 year period.

From there, it is evident that yields vary from 0 for the variety Cornish marl, till 9566 kg. of dry hay, per hectare, for the variety „Niederrheinischer", that justifies the experimental discovery of the best types, in connection with the given ecological conditions.

7. Regarding the yield of the cultivation of *Trifolium pratense,* in mixture with *Lolium perenne,* data are also given for a 4 year period.

The cultivation of the mixture under the climatic conditions of Jannina, does not show large differences when the mixture is cultivated in the same row for the two plants or in alternative rows: because the moisture was enough to fulfill the needs of the crops conveniently. *Trifolium pratense* from the second year of cultivation is surpassing *Lolium* in the mixture yield and from the third year the field is occupied by a pure cultivation of *Trifolium pratense,* which has a greater adaptability to the conditions of growing, which are approaching to the conditions of Central Europe.

8. Regarding the yields of the cultivation of 27 different varieties of *Lolium perenne* (cultivation of spaced plants) at Larissa reciprocal data are given in table No. 16.

Table 13. *Comparative cultivation of different varieties of Trifolium pratense, in spaced plants, at Jannina, during the two-year period 1955—1957, under irrigation.*
Date of sowing 20/10/1955.

No.	Strains of *Trifolium pratense*	Average number of stems per plant	Average number of internodes, per plant	Average length of stems in mm.	Hairness % *	Total plant mortality %		
						1956	1957	Total
1.	Montgomery	56	246	462	36,6	74,1	50,0	87,0
2.	Resistenta	58	376	628	60,8	34,0	29,0	53,2
3.	Merkur	50	362	644	45,0	48,3	32,3	65,0
4.	Lodi No. 69	35	188	436	89,4	82,8	10,0	84,5
5.	Silo	51	219	592	71,7	61,0	21,7	69,5
6.	Mont-Calme 950	36	108	392	60,0	78,9	66,7	93,0
7.	Göta	58	333	722	77,0	31,0	47,5	63,8
8.	Steinacher	43	202	514	65,2	86,7	37,5	91,7
9.	S-123	66	469	585	61,7	63,6	45,0	80,0
10.	Leisi	34	110	383	74,2	86,0	50,0	93,0
11.	Daeno III	52	474	572	42,1	10,0	31,1	38,0
12.	C. B.	47	129	466	46,2	80,8	20,0	84,6
13.	Resistant Øtofte	44	131	459	70,0	76,8	7,7	78,6
14.	Mölstad	46	265	518	61,7	49,1	20,0	59,3
15.	Isella	44	137	453	89,4	58,2	30,4	70,9
16.	Essex	57	168	486	46,6	93,1	66,7	98,3
17.	Cornich marl	84	381	387	49,1	78,6	44,4	88,1
18.	Kühn	42	149	456	68,3	82,5	10,0	84,3
19.	Cotswold Single cut	39	464	579	25,0	93,1	50,0	96,6
20.	Essi	53	184	487	70,0	77,8	58,3	90,7
21.	Niederrheinischer	41	137	466	73,6	85,4	50,0	92,7
22.	*Trifolium pratense* (M-2749)	40	139	461	0,0	81,2	33,3	87,5

* Percentage of stems with less than 5 hairs per cm. of length.

Table 14. *Average yields of dry hay, in kg. per hectare, of different varieties of Trifolium pratense, at Jannina, during the 4 year period 1955—1959, under irrigation.*
Date of sowing 20/10/1955.

No.	Strains	Annual yields of Dry Hay kg. per hectare					Numb. of cuts				Density		Height of the 1st cut in cms.			
		1956	1957	1958	1959	Average	1956	1957	1958	1959	1956	1959	1956	1957	1958	1959
1.	Montgomery	5024	11526	5717	1414	5920	3	3	2	2	3,9	0,7	39	58	54	35
2.	Resistenta	6946	15806	9282	2582	8654	3	3	2	2	4,9	1,2	56	61	57	34
3.	Merkur	6004	15684	8145	2959	8198	3	3	2	2	4,6	1,7	55	64	62	37
4.	Lodi No. 69	8582	16927	6387	5200	9274	3	3	3	2	4,6	2,1	61	47	60	39
5.	Silo	6250	14214	6625	2346	7359	3	3	2	2	4,5	1,0	59	62	64	36
6.	Mont-Calme 950	6074	16062	6232	2079	7612	3	3	3	2	5,0	1,0	62	71	61	40
7.	Göta	6918	15505	7005	1221	7482	3	3	2	2	5,0	0,2	49	66	59	30
8.	Steinacher	5949	16539	6912	2675	8019	3	3	3	2	4,7	1,1	57	65	64	44
9.	S-123	3457	10459	5577	1247	5185	3	3	2	2	3,7	0,4	29	55	50	30
10.	Leissi	6081	15977	9167	2387	8403	3	3	3	2	4,9	1,0	64	59	63	42
11.	Daeno III	6088	14012	8874	1709	7671	3	3	3	2	4,9	1,3	50	66	67	28
12.	C. B.	4826	16602	7106	1581	7529	3	3	3	2	2,7	0,4	52	76	61	32
13.	Resistant Øtofte	8104	17565	10107	2031	9452	3	3	3	2	4,5	1,1	69	62	69	40
14.	Mölstad	3797	11847	4690	580	5228	3	3	2	2	4,0	0,3	30	65	42	25
15.	Isella	6941	17439	8223	4302	9226	3	3	3	2	5,0	2,7	54	53	56	44
16.	Essex	6832	16499	7486	1450	8067	3	3	3	2	3,7	0,4	59	65	66	43
17.	Cornish marl	—	—	—	—	—	—	—	—	—	0,3	—	—	—	—	—
18.	Kühn	8047	17980	8496	2247	9192	3	3	3	2	4,7	1,8	60	71	66	40
19.	Cotswold single cut	8349	13725	7165	1779	7754	3	3	2	2	4,4	0,5	61	61	61	42
20.	Essi	6621	16747	8159	2641	8542	3	3	3	2	4,4	2,2	56	71	65	40
21.	Niederrheinischer	7824	19384	7150	3905	9566	3	3	3	2	4,7	2,2	66	65	67	42
22.	M-2749(C.M. VOLKMAN)	4251	14157	7140	2560	7027	3	3	3	2	2,2	1,1	42	67	70	45

Density has been graduated with 5,0 for the best and 0,0 for the worst.

The 25 annual investigations of the Institute prepared and served the advances of agricultural science and of a progressive practical agronomy, to the development of the grassland agriculture; because is now becoming possible to reach great improvements through the utilization of the introduced, discovered or created new high yielding varieties of forage and other crops, which are better suited to the new conditions with the severely eroded and highly degradated soil.

In this way, Greece could follow the way, which other countries traversed, as mentioned by WILLIAM DAVIES (7) for the United Kingdom, by F. R. CALLAGHAN (8) for New Zealand, by D. G. HAYLETT (9) for the Union of South Africa, by B. P. PAL for India (10) and others.

Greece could create new possibilities for its agricultural evolution, as GRIFFITHS DAVIES (11) and other have stressed to be possible for Australia, which succeeded increasing its herbage production in such a way to represent about the third of the total production, instead of as in Greece, where it is less than 10% of the total agricultural production (1956).

With the introduction of new agronomic practices the livestock production will also be increased, and in proportion, the food production to 3 percent,

Fig. 7. Cultivation of a mixture of *Phalaris tuberosa* and Berseem clover, at Larissa.

which is today according to E. J. RUSSELL (12) the "overall annual increase in world food production", and in such a way to compass the increase of Greek population of some 1,3%, annually. With the appropriate development of the leguminous crops the balance of N., would also be improved as ROLAND MCKEE mentioned for the Un. States (13 p. 87).

Elsewhere (14) is refered, extensively, to the evolutional phases of the Hellenic agriculture, the progresses done, and the proper solutions for the most actual agricultural problems, in Greece.

4. Conclusions

1. Greece is now passing through a transitive phase, from an extensive agriculture, with a low-yielding livestock, to an improved one, with a more intensive utilization of its natural agricultural resources.

2. For the increase of its wealth, there is a need for improvement of the soil productivity, which is for

Table 15. *Average yields of dry hay, in kg. per hectare, of mixtures of different varieties of Trifolium pratense, with Lolium perenne, at Jannina, during the 4 year period 1955—1959, under irrigation, with sowing in the same and in alternative rows (5—8).*

No.	Strains	Average yields of Dry Hay kgs. per hectare	Density		Percentage of *Trifolium* in the mixture				Numb. of cuts				Height of 1st cut of *Trifolium*			
			1956	1959	1956	1957	1958	1959	1956	1957	1958	1959	1956	1957	1958	1959
1.	M-2749 + M-4667	7578	4,2	2,2	50,0	87,2	100	100	3	3	3	2	35	60	62	45
2.	Cotswold + M-4667	7914	5,0	—	56,6	92,1	100	100	3	3	2	2	40	55	45	40
3.	S-123 + M-4667	6379	4,0	—	16,5	48,2	100	100	3	3	2	2	40	30	45	35
4.	Essex + M-4667	7709	3,5	1,5	40,7	100,0	100	100	3	3	3	2	40	65	50	35
5.	M-2749 + M-4667	6267	4,4	1,1	38,1	90,1	100	100	3	3	3	2	42	59	46	44
6.	Cotswold + M-4667	8039	5,0	1,1	79,8	97,3	100	100	3	3	2	2	40	55	60	40
7.	S-123 + M-4667	3725	5,0	1,2	64,3	92,5	100	100	3	3	2	2	35	50	35	35
8.	Essex + M-4667	4947	5,0	2,5	59,3	100,0	100	100	3	3	2	2	30	60	65	45

Density has been graduated with 5,0 for the best and 0,0 for the worst.
Lolium perenne from North-King and C°, Berkeley 10, California (M-4667).
In the mixtures 1—4 *Trifolium* and *Lolium* have been sowed in the same row, while at the last four numbers the sowing has been made in alternative rows.

Table 16. *Average yields of dry hay, in kg. per hectare, of spaced plants of different varieties of Lolium perenne, at Larissa during the three year period, 1954—1957, under irrigation. — (Results of two experimental fields).*

No.	Strains	Average yields of hay kg./hect. (per year).			Average Number of inflorescences per plant			Average plant mortality %		
		First Exp. F. 1954—1956	Second Exp. F. 1955—1957	Average	1956	1957	Average	1954—1956	1955—1957	Average
1.	R.Y.P. Melle Haytype	3560	3120	3340	212	193	202	1,69	5,80	3,74
2.	Primevere	7240	3440	5360	256	190	223	9,68	11,67	10,67
3.	Odenwalder	3280	2920	3100	192	176	184	5,18	12,86	9,02
4.	Steinacher	3460	2560	3010	224	185	209	6,66	18,33	12,99
5.	C. B. Hooitype	6400	3780	5090	199	167	183	8,71	8,33	8,52
6.	Vroeghoitype	2600	2440	2520	196	170	183	10,55	16,67	13,61
7.	Delta	4620	3160	3890	215	184	199	26,25	21,43	23,84
8.	S-24	4960	3740	4350	277	239	258	6,21	11,64	8,92
9.	Devon eaver	5900	2880	4390	317	249	283	8,66	11,60	10,13
10.	Northern Ireland	3420	1900	2660	200	135	167	6,85	45,00	25,92
11.	R.Y.P. Melle Pasture type	2440	2420	2430	54	73	63	4,24	6,67	5,45
12.	Hunsballe II	4200	3940	4070	185	186	185	11,03	8,57	9,80
13.	Trianon	4950	2720	3835	224	162	193	7,18	21,67	14,42
14.	Glasnevin leafy	4100	3260	2680	197	178	187	6,87	8,57	7,72
15.	Sceempter weidetype	4540	3700	4120	67	108	87	6,11	8,33	7,22
16.	Weidetype barenza	3000	3440	3220	53	81	67	6,97	10,00	8,48
17.	Mommersteeg's Hooitype	3200	2820	3010	100	146	123	7,80	15,25	11,52
18.	Hooitype barenza	3260	2960	3110	150	147	148	5,18	8,86	7,02
19.	S-23	3180	2720	2950	120	122	121	1,72	6,78	4,25
20.	S-101	3020	2260	2640	141	118	129	6,07	17,24	12,15
21.	Kent	3080	3240	3160	166	181	173	2,50	14,71	8,60
22.	Silding Øtofte II	4020	3620	3820	186	229	207	5,99	11,67	8,83
23.	Victoria	—	2380	—	—	183	—	—	37,93	—
24.	*Lolium* of UNRA (M-2340)	3620	—	—	96	—	—	72,46	—	—
25.	*Lolium* of VOLKMAN (M-2727)	5500	—	—	115	—	—	19,40	—	—
26.	*Lolium* of VOLKMAN (M-2742)	4440	4300	4370	136	255	195	22,61	20,00	21,30
27.	*Lolium* of U.S.A (M-4667)	2350	2740	2545	205	185	195	18,85	23,73	21,29

ever degrading from over-grazing, which „is indeed one of the chief causes of erosion": repairing at the same time its colossal losses both material and cultural, which has been suffering, for millenniums of years.

3. The improvement of the soil productivity will be realized in a quicker and more convenient way by the introduction of the proper enriching plants and by the application of productively balanced systems of rotation; a thing that is now possible by using the new varieties discovered, introduced or created by the Hellenic Agricultural Research Institute, under the general leadership of the Ministry of Agriculture.

4. The growth of the enriching legumes is greatly increased and strengthened potentially, by the simultaneous heavy use of P_2O_5, which is, under the poor content of the Hellenic soil, in phosphorus, inseparable and not at all indispensable, for the insuring of the highest productive profits.

5. The increase of the livestock production, for an equivalent participation in the agricultural income of the Country, can be brought about by the improvement of the pastures with the use of promoted ecological methods; and also with replanting methods, with sowing or planting introduced good grasses and legumes types, reinforced with phosphoric acid fertilizer, to ensure full growth and economical development: with equivalent promotion of the protein and oil producing crops, for the fullest use of sunlight and rainfall and the maintaining of the soil in a fertile condition by building large reserves of humus.

6. The practice of the drassland Acriculture in Greece would help decisively to increase the resilience which will enable it to progress constantly toward Mixed Farming: with higher flexibility, better competitive specialization and safer economic stability.

7. Over twenty-five years of investigations of the Institute had as result to give experimental and other data, which promoted the adequate solution of problems of fundamental national importance: it also makes possible the general improvement of the production of Greece, and in such a way, that it is participating through its experimental work to the leadership in agricultural progress in Hellenic agriculture, by attempting to change the thought of the people into the new direction of the grasslands policy and elucidating about the vital importance of this progressive healthy and salutary idea for Greece.

Acknowledgements

We should like to take this opportunity of expressing our warmest thanks to all who have collaborated in carrying out the work involved. In particular should be mentioned the agronomists A. Ailianos, and E. Tsogas, the statistician Miss H. Gianniou, and Miss G. Platanissiotou, for her contribution in preparing the manuscript. —

Zusammenfassung

Fortschritte im Feldfutterbau in Griechenland

Die griechische Landwirtschaft befindet sich zur Zeit in einem Übergangsstadium: An die Stelle des bisherigen extensiven Getreideanbaus mit geringer tierischer Produktion tritt mehr und mehr eine intensive Bewirtschaftung unter Ausnutzung der vorhandenen natürlichen landwirtschaftlichen Hilfsquellen.

In erster Linie ist eine Erhöhung der Bodenproduktivität erforderlich. Sie verringerte sich durch jahrtausendelangen einseitigen Getreideanbau und heute sind jährlich erhebliche Erosionsschäden zu verzeichnen.

Die Erhöhung der Bodenproduktivität wird am besten durch den Anbau bodenverbessernder Pflanzen und eine ausgeglichene Fruchtfolge erreicht. Das ist durch die von der Hellenic Agricultural Research Institute unter Leitung des Landwirtschaftsministeriums ermittelten, eingeführten oder gezüchteten Sorten möglich geworden.

Auch die tierische Produktion kann auf verschiedene Weise gesteigert werden: Durch Verbesserung der Weiden, durch Neuanpflanzung von ökologisch geeigneten Gras- und Leguminosenarten bei verstärkter Phosphorsäuredüngung, um Wachstum und Entwicklung zu fördern, weiterhin durch den Anbau von eiweiß- und ölhaltigen Pflanzen, durch größtmögliche Ausnutzung der klimatischen Gegebenheiten und Erhaltung der Bodenfruchtbarkeit unter Aufbau großer Humusreserven.

Die über 25jährige Forschungstätigkeit des Hellenic Agricultural Research Institute brachte Ergebnisse, die wesentlich zur Lösung dieser Probleme, die von grundlegender nationaler Bedeutung sind, beitrugen. Durch ihre experimentelle, lenkende und aufklärende Arbeit ist die Station am Fortschritt der griechischen Landwirtschaft führend beteiligt.

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