Efficiency of Balanced Rotations for Increasing Food Production and Improvement of Soil Fertility in Greece

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At the present time Greece is under considerable pressure to increase its food production. A previous report (1) has summarized pertinent data and recommendations on land use to overcome the continuous (monocultural) and exhausting system of farming.

In 1951, through authorization of the U. N. Food and Agriculture Organization a group of scientists including C. M. Donald, Principal Research Officer, Division of Plant Industry, C.S.I.R.O., Australia; Prof. Ford S. Prince, Professor of Agronomy, University of New Hampshire, and Dr. R. O. Whyte, grassland and forage consultant to F.A.O., visited the Station at Larissa, Greece, and have presented their report (2). In 1952, Dr. O. S. Aamodt, U. S. Department of Agriculture and Consultant, Plant Production Branch, Agricultural Division, F.A.O., also visited the Station. It was felt that the results reported in this manuscript would be of value to Mediterranean and other countries.

Experimental Results

The Experiment Station at Larissa, Greece, was established in 1933. One of the first objectives was to find legumes that were superior to existing types in adaptation. These investigations have been very successful. For example a new variety of *Lathyrus*, L. 92, has yielded 2,000 Kg. in comparison to 590 Kg. per hectare for the local late variety of vetch, Larissa M. 366 in a 5-year test. Data comparing yields of the most important new varieties with local strains are summarized in table 1.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield in Kg. per hectare</th>
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<tr>
<td></td>
<td>Autumn seeding</td>
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<tr>
<td>Chickpea, Local var. (E.68)</td>
<td>225 ± 10.0</td>
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<tr>
<td>Vetch, Late local var. (M.2281)</td>
<td>486 ± 7.6</td>
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<tr>
<td>Ervil* (M.1008)</td>
<td>689 ± 12.5</td>
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<tr>
<td>Lentil, Improved (φ.1)</td>
<td>1081 ± 6.8</td>
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<tr>
<td>Vetch, Early improved (Bi.22)</td>
<td>1243 ± 10.1</td>
</tr>
<tr>
<td>Lathyrus, Improved (A.92)</td>
<td>1523 ± 6.7</td>
</tr>
<tr>
<td>Chickpea, Improved (M.2169)</td>
<td>1329 ± 7.8</td>
</tr>
</tbody>
</table>

* Vicia Erubia, Wild. (Bitter vetch).

The higher yields (especially from autumn) from improved varieties of annual legumes form an important basis for the major portion of this study. The comparison of wheat yields in wheat-legume rotations with the generally adopted system of wheat-cereal-fallow as a first step toward the “integration” of agriculture and livestock production.

A study of rotation systems for wheat was established in 1937, and except for 1944-45 due to extension work, results have been obtained annually for the past 13 years. In this experiment 10 two-year rotation systems have been studied with 10 plots (6 x 10 m. in size) each year, half-to each treatment. The treatments included are as follows:

1. Continuous wheat
2. Fallow, not tilled from harvest to next seeding—wheat
3. Fallow, tilled from harvest to next seeding—wheat
4. Peas for grain—wheat
5. Broad beans for grain—wheat
6. Crimson clover for forage—wheat
7. Vetch for grain—wheat
8. Peas plowed under in bloom—wheat
9. Lathyrus for grain—wheat
10. Lentil for grain—wheat

Average yields for crops grown in the above two-year rotation systems are summarized in table 2 and figure 1.

The monocultural system of wheat—wheat, eventually in “productive bankruptcy,” yields, deterioration of soil structure, and control weeds. Although the peas plowed under rotation system produced slightly less wheat in yield from wheat annually in two years, its use is recommended because of its value for improvement of the physical, chemical, and biological properties of the soil. By including annual legumes for grain these systems have advantage from the combined values of soil improvement, wheat yields, and fodder for livestock feeding. This would be true for the plains of East Thessaly, where rainfall is greater than 500 mm. distributed during the autumn and winter.

The third phase of this investigation included the response of annual legumes to levels of nitrogen and phosphate fertilizer. In this study, eight varieties of legumes representing seven species have been tested at four fertilizer treatments as follows:

1. Continuous wheat
2. Peas for grain—wheat
3. Broad beans for grain—wheat
4. Crimson clover for forage—wheat
5. Vetch for grain—wheat
6. Peas plowed under in bloom—wheat
7. Lathyrus for grain—wheat
8. Lentil for grain—wheat