

# PROGRESS WITH SCREENING *LOTUS* SPECIES AND VARIETIES ON AN ACID, LOW-PHOSPHATE SOIL TYPE IN UK

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## INTRODUCTION

In common with much of Western Europe, the United Kingdom is experiencing a surplus in products from ruminant livestock farming. As a first reaction to this situation, research attention has been directed to low-input, more extensive grassland management systems based on grass-white clover associations. Although not requiring inputs of fertilizer nitrogen, white clover does require regular inputs of lime to maintain near neutral soil pH and, on UK soils, often requires inputs of both potassium and phosphorus (P) for optimal performance. To investigate a forage legume, with more genuinely low-input potential than white clover, which would be able to grow in soils of low pH and depleted P status, a collection of representative species and cultivars of the genus *Lotus* was assembled during 1988-89, and preparations made for sowing.

North Wyke Research Station is situated in Devon, on the South-West peninsula of Britain, with a mild maritime climate. Mean January air temperature is 4.5°C, mean July temperature 15.3°C. Average rainfall is 1035mm, with approximately 200 raindays. There are on average 1448 hours of sunshine per annum.

## INITIAL SCREENING OF *LOTUS*

All seed was inoculated with a commercial source of *Rhizobium* and sown in August 1989 with Timothy (*Phleum pratense*) as a companion grass. The experimental site was an old permanent pasture, which was ploughed and cultivated. The soil was a poorly-drained, seasonally water-logged silty clay loam (clayey pelostagnogley), with pH in the surface 10 cm of 5.4 and available P <10 ppm. Three randomised blocks of the materials listed in Table 1 were sown. In addition, plots of Menna white clover and of Big Deervetch (*L. crassifolius*) had been included in the design. The white clover showed very poor establishment, and a routine check on the soil pH in October 1989 revealed that incorporation of sub-soil during cultivations had lowered surface pH to 4.9. Lime was applied following the first cut in 1990, and restored pH to about 5.5. The Big Deervetch seed proved to have very low germination when tested in the laboratory, and also failed to establish.

*Lotus* growth in spring 1990 was poor, and swamped in early season by very dense stands of *Holcus* spp. and other native grasses germinating from the buried seed bank. This was cut in May at a height of about 6.0 cm and removed before the native grasses shed seed, and a second crop allowed to develop. The *Lotus* was able to compete more strongly with the grasses in this crop, and flowered. The crop was cut and removed in autumn, after top growth had died back.

The second harvest year saw the vigour of the native grasses much reduced, and it was possible to take two cuts from the plots, on 3 July and 21 August. The first cut was made at 7.5 cm, the second at 5.0 cm, using a Haldrup 1500 plot harvester. Fresh yields from each plot were recorded on the harvester, and two sub-samples were collected. The first was dried in a forced-draught oven at 100°C to constant weight, to determine the dry matter (DM) content, and the second subsequently sorted to determine the proportions of *Lotus* and grass DM.

## RESULTS – 1991

The data for the DM yield of *Lotus* is shown in Table 1. Top annual yields of *Lotus* DM came from the two cultivars of *L.uliginosus*, with approximately 40% of the total herbage yield contributed by the legume component. Good yields also came from the *L.corniculatus* cvs. Cascade and Norcen, which had approximately 30% of legume in the total herbage DM yield. *L.tenuis* cv. Blenheim also gave moderate yields, but this cultivar and those with lower yields only contributed about 20% legume DM to their total herbage DM yield.

Table 1. Annual DM yields of *Lotus* species and varieties, 1991 (t ha<sup>-1</sup>)

| Species                    | Cultivar              | Lotus DM |       | Annual Yield |           |
|----------------------------|-----------------------|----------|-------|--------------|-----------|
|                            |                       | Cut 1    | Cut 2 | Lotus DM     | Total DM† |
| <i>L.uliginosus</i>        | Maku                  | 1.92     | 1.48  | 3.40         | 7.71      |
|                            | Marshfield            | 0.81     | 1.40  | 2.21         | 5.72      |
| <i>L.corniculatus</i>      | Cascade               | 1.03     | 1.17  | 2.20         | 7.26      |
|                            | Norcen                | 1.28     | 0.88  | 2.16         | 6.83      |
| <i>L.tenuis</i>            | Blenheim              | 0.35     | 1.11  | 1.46         | 6.00      |
| <i>L.corniculatus</i>      | Empire                | 0.40     | 0.90  | 1.30         | 5.87      |
| <i>L. c. ssp. arvensis</i> | Kalo                  | 0.44     | 0.86  | 1.30         | 5.90      |
| <i>L.corniculatus</i>      | GA-1                  | 0.52     | 0.67  | 1.19         | 5.36      |
|                            | AU-Dewey              | 0.51     | 0.66  | 1.17         | 6.13      |
|                            | Fergus                | 0.33     | 0.79  | 1.12         | 5.52      |
|                            | s.e.d.<br>(22 df)     | 0.349    | 0.322 | 0.597        | 0.758     |
|                            | Level of significance | ***      | **    | ***          | **        |

† includes grass and other plant DM

## FURTHER RESEARCH

The DM yields reported in Table 1 were achieved under cutting, but it must be remembered that the most likely method of utilisation for such a low-input legume will be by

the 38 grazing animal. In such circumstances, there will be a premium on various *Lotus* ecotypes with a rhizomatous growth habit. Such ecotypes from Morocco were reported by Kallenbach *et al.*, (1989) and are also being maintained at IGER, Aberystwyth (A.T. Jones, *pers. comm.*). There appears to be a good case for re-opening studies on the productive capacity of these rhizomatous ecotypes.

Prompted by the experience in 1990, when the *Lotus* became swamped by the vigorous growth of native grasses, a further experiment has been planted at North Wyke in 1991 to investigate the effects of four companion grasses on *Lotus* performance. *L.uliginosus* cv. Maku and *L.corniculatus* cv. Leo were sown in June 1991, with *Festuca pratensis* cv. Senu, *Poa pratensis* cv. Asset, *Phleum pratense* cv. Aberystwyth S.48 or *Agrostis capillaris* cv. Muster, each at a high and a low seed-rate. A clean site in an arable field was chosen, to avoid the burden of native grasses found in the old permanent pasture field. Establishment has been good, and data will be recorded from 1992.

## Reference

Kallenbach, R.L., McGraw, R.L. and Beuselinck, P.R. 1989. Rhizomatous birdsfoot trefoil: an evaluation of its potential in Missouri. *Lotus Newsletter*, **20**, 23.