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A STUDY OF HERBAGE AND SEED PRODUCTION
OF LUCERNE (MEDICAGO SATIVA L.) UNDER
DIFFERENT PLANT SPACING AND CUTTING
TREATMENTS

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ABSTRACT

The present study on lucerne cv. "Wairau" was carried out in two separate trials, - a herbage and seed production trial and a seed development trial. The purpose of the first part was to investigate the effect of cutting and spacing on herbage production and subsequently on seed yield. In the second part, changes in seed weight, moisture content, and viability during various stages of seed development were studied.

Results from the herbage study suggested that fresh and dry herbage yield were both affected more by plant spacing than by the height of cutting and the stage of plant development at the time of cutting. Close plant spacings resulted in higher yields of both dry matter per unit area and dry matter percentage than wide spacings. The study showed that lucerne plants in first year crops should be grown at a plant density higher than 44 plants per sq. metre and up to 100 plants per sq. metre to reach maximal herbage yield per unit area. Early cutting and high cutting gave a significantly lower herbage yield than when plants were cut late and cut at a low stubble height.

Cutting and spacing treatments had a profound influence on seed yield per unit area. Seed production in lucerne, unlike herbage production, depended mainly on seed yield per plant rather than on the number of plants per unit area. Both cutting and spacing treatments affected seed yield per plant by altering the number of reproductive shoots, number of flowers per plant and the percentage of seed set. Plants grown at wide spacings produced more branches and flowers per plant and also exhibited a higher percentage seed set, thereby producing high numbers of seeds per plant. To obtain high seed yield in this variety of lucerne, plants should be grown at a plant density of approximately

11-25 plants per sq. metre. Cutting lucerne plants prior to allowing them to seed resulted in a weakening of the plants, severely depressed reproductive potential, delayed flowering time and subsequently affected flower production and percentage seed set. Lucerne plants should therefore not be cut at all in the year of plant establishment if high seed yields are expected.

Seed development followed three distinct phases. The growth stage involved the period up to 22 days after pollination. At the end of the stage, 3% of seeds were germinable. The food reserve accumulation stage occupied the period from 23-40 days after pollination. Maximum seed dry weight was attained after 40 days at a seed moisture content of 58%. The ripening stage occupied the period from 41-75 days after pollination. At the end of this stage seed moisture content was approximately 14% and subsequently 6% of hard seed were found when seeds were tested immediately after harvest. Storage results in this trial indicated that immature seed tended to lose germination capacity more rapidly than mature seed. To ensure high seed quality in lucerne it was essential that seed be harvested after maturity.

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1. INTRODUCTION

Lucerne (Medicago sativa L.) is an important forage crop in many farming systems. As suggested by Ellison (1958) lucerne has a number of general merits in agriculture such as building and restoring soil fertility and as a high quality material for animal feeding. Other satisfactory aspects of lucerne, include its capability of producing higher (20-100%) dry matter yield than other pasture crops particularly under drought conditions; providing high quality hay at a critical time of the year (Janson 1974) and also richness of protein which is well recognized (Woodman et al 1933). This species is also known to outlast pasture and is economical irrespective of sowing costs (Janson 1974). It has also been reported by a number of workers (Keoghan 1967, Langer 1972) that good recovery after being cut or grazed is one of the outstanding characteristics of lucerne. All these characteristics render it suitable to fit well into the complete agricultural system where cutting or grazing is involved. One of the main problems facing lucerne growers is the continual supply of sufficient high quality seed for sowing. Seed production in this crop has always been thought of as relatively low and unreliable, varying from place to place and from season to season. Doull (1967) stated that while in many countries lucerne seed production yields in the range from 112-168 kg/ha. are common, exceptions occur in some areas with seed yields being as high as 2422 kg/ha. A great variation in lucerne seed yield may occur in different years as reported by Zaleski (1963). He quoted an example in Great Britain where seed yield of lucerne grown on the same site was recorded at 101 kg/ha. in one year, whereas it was 482 kg/ha. in the following year. These figures suggest that seed production in

lucerne varies greatly depending on environmental conditions. A lack of sufficient information about crop management could be another factor governing the success of growing lucerne for seed. Initial research into ways of increasing the seed yield of lucerne began as early as 1935, but there is still a great need for more study.

Plant spacing plays an important role in seed crop production since yield per unit area is a function of seed yield per plant and number of plants in a certain area. It is possible that different plant spacings could be one of the factors governing both lucerne herbage and seed yield. As knowledge of sowing patterns with lucerne is somewhat inconsistent and little guidance was obtained from previous work, it was decided to investigate the effect of square planting lucerne at different spacings to determine the effect of such treatments on seed yield.

Since lucerne is a perennial forage crop, plants can be grown either for forage or seed production. In normal practice it is common for farmers to cut lucerne for hay and then harvest for seed later in the same season. As the effect of previous cutting on the plant and on seed production is not clearly documented it was decided to investigate the effects of cutting on subsequent seed yield in the seeding year.

This study is presented in two sections; a herbage and seed production trial and a seed development trial. The purpose of the herbage and seed production trial was to investigate the effect of cutting lucerne plants at the young stage of plant development (bud stage, 12 weeks after sowing) and at a more mature stage (full flowering stage, 16 weeks after sowing) on herbage yield and seed production. In addition the

effect of height of cutting on herbage regrowth at different stages of plant development was also investigated. The effect of cutting on subsequent seed production was also studied using plants grown at 4 different plant density spacings. Various components which might be expected to have a bearing on seed production and yield were also examined.

In any seed crop production programme the quality of seed needs to be considered along with the amount of seed harvested. To assess this aspect a seed development trial was carried out to monitor changes in physiological components and seed quality in relation to seed age. The onset of hard seed formation and the effect of harvesting time and storage treatment on hard seed percentage was also studied.