Proceedings of the New Zealand Grassland Association *45:* *239-242* (1984)

SEED PRODUCTION OF SULLA — A PLANT FOR SOIL CONSERVATION

G.B.DOUGLAS
Soil Conservation Centre, MWD, Palmerston North.

Abstract

Sulla *(Hedysarum* coronarium L.) is suitable for soil conservation work because it fixes nitrogen, grows satisfactorily over a wide range of soil conditions and tolerates drought and coastal conditions. A nursery trial conducted on a Manawatu fine sandy loam examined the effect of sowing rates (20, 40 and 60 kg/ha) and dehulling seed on establishment and forage and seed production. While increasing seed rate and dehulling seed resulted in more rapid establishment (higher plant densities, ground cover and canopy height) they did not affect forage or seed yields at harvest six months later.

Keywords: sulla, soil conservation, hulling.

INTRODUCTION

Sulla ***(Hedysarum coronarium*** L.) is a short-lived, perennial legume originating from the Mediterranean where it is used widely for hay, silage and greenfeed (Whyte et ***al.,*** 1953; Kernick, 1978). It has been evaluated in New Zealand by the Soil Conservation Centre, Aokautere, Ministry of Works and Development, for revegetation of slips and gullies, semi-arid sites and industrially disturbed land, and as a component in hydroseeding mixtures for rail and road batters (Watson, 1982). The species has shown wide adaptability, proving satisfactory under a range of soil pH (4.0-8.5) and in tolerance to drought and coastal conditions throughout New Zealand. In particular, sulla has shown promise in revegetating badly eroded areas in the Gisborne district, where the lucerne and phalaris used previously have proved unsatisfactory (Kissock, ***pers.*** *comm.).*

There are several features which make sulla attractive for soil conservation. The species is a legume and can therefore fix nitrogen efficiently provided it is inoculated successfully with the appropriate *Rhizobium* strain. Seedling development is rapid, resulting in early establishment of a protective, vegetative cover, and a strong, branched taproot provides a soil stabilising effect. The dried-off herbage mat, up to 0.2-0.3 m thick, provides a favourable environment for seed germination and subsequent re-establishment.

The seed is produced in flattened, slightly spiny hulls (Kernick, 1978). Removal of the hull generally results in more rapid and uniform germination, but the necessity for this practice probably depends predominantly on the hard seed content.

The success of sulla in soil conservation work and the desire to conduct more trials in problem areas, has prompted investigation into efficient methods of seed multiplication, Some preliminary results from a trial examining the effect of three sowing rates and dehulling seed on establishment and forage and seed production are presented.

MATERIALS AND METHODS

The experiment was sown at the Soil Conservation Centre, Aokautere, on 20 October 1982 on a Manawatu fine sandy loam (O-7.5, cm pH 5.5). The site received lime (4.5 t/ha) and 30% potassic superphosphate (0.5 t/ha) two weeks before sowing, Trifluralin (1.2 kg ai/ha) and dinoseb amine (1.6 kg ai/ha) were used for weed control before sowing and after emergence, respectively.

A split-plot randomised complete block design with three replicates employed sowing rates (20, 40 and 60 kg/ha) as main-plots and unhulled and dehulled seed treatments as sub-plots. The latter were 6 x 2 m with 1 m buffer strips in between. Freshly inoculated seed was broadcast and then covered lightly.

Characters recorded were plant density, canopy height, stem diameter 0.4 m above ground, ground cover (%), time to first flower, leaf/stem ratios of vegetative and flowering shoots, and seed and forage yield.

RESULTS

Sowing rate and seed treatment had dramatic effects on plant density at 55 days (Table 1). Increasing sowing rates and dehulling seed both resulted in significant increases in this character. They interacted in such a way that plant density from a 20 kg/ha dehulled sowing was similar to that of a 40 kg/ha unhulled sowing, while plant density from a 40 kg/ha dehulled sowing was significantly greater than from a 60 kg/ha unhulled sowing. Highest plant densities overall were from 60 kg/ha dehulled sowings. Dehulled seed generally resulted in approximately a doubling in plant density. For ground cover, there were significant ($P<0.05$) increases at each sowing rate from using dehulled compared with unhulled seed (Table' 1). All dehulled sowings, except 20 kg/ha, produced greater cover after 64 days. The benefit of sowing dehulled seed at some rates was also shown for canopy height and time of first flowering (Table 1). All other characters were not significantly affected by treatment.

DISCUSSION

A similar trend of increasing plant density in response to heavier sowing rates (Table 1) was reported in Italy (Restuccia, 1974). Using unhulled sowings of 80, 120 and 160 kg/ha, mean plant densities at harvest were 75.6, 90.8 and $140.5/m^2$, respectively.

The plant densities for 40 and 60 kg/ha unhulled treatments in this experiment (143.0 and $199.3/m^2$ respectively) were considerably higher than those of Restuccia (1974), despite using much lower sowing rates, while plant density for 20 kg/ha plots was approximately equal to that obtained by Restuccia (1974) from 80 kg/ha plots. Several reasons may account for lack of agreement between these results. Data in the present study were obtained only in the first nine weeks of establishment whereas those of Restuccia (1974) were determined at harvest. It is suggested that continued competition in the Aokautere trial may in time have reduced plant density as there was a wide range in stages of seedling development present at 55 days, particularly in several unhulled treatments. It is quite likely that after nine weeks some of the relatively young seedlings could have been adversely affected by taller seedlings particularly with respect to shading. Furthermore, plant densities at harvest might have been similar as suggested by the lack of differences in forage yields. Other factors which may account for discrepancies between the two studies are genetic variability for growth habit (erect/prostrate) and the hard seed content (Kernick, 1978).

Denser sowings may ensure the development of fine stems (Whyte et *al.*, 1953; Kernick, 1978), which facilitates easier drying and harvesting (Watson, 1982). A significant effect of sowing rate on stem diameter was not shown presently (Table l), probably because of an insufficient range of sowing rates.

Higher plant densities were achieved by removing the seed hull (Table 1), a finding that was undoubtedly considered by Kernick (1978) in his recommendations for sowing rates of unhulled and dehulled seed. Dehulling also resulted in more rapid germination and early development of ground cover, results of some relevance to soil conservation work where a quickly developing vegetative cover is desired. However, approximately four to five months after sowing, ground cover was complete irrespective of whether the hull was removed or not.

For hill country revegetation, oversowings of unhulled and dehulled seed may each offer one or more advantages. Dehulled seed lodges more readily in cracks and microdepressions (Watson, 1982) and as shown in this study might provide a more rapid vegetative cover. Unhulled seed has a greater resistance to downslope movement and germinates over a longer period (Watson, 1982), which may give some protection against possible 'false strikes'. More research is required before the superiority or otherwise of either seed treatment on such sites can be determined. In hydroseeding work, the hull is softened so that the advantages of dehulling are not applicable.

Despite the significant early effects in this study, the treatments imposed had no effect by harvest time on leaf/stem ratios and seed and forage yields (Table 1). It is therefore suggested that for satisfactory yields there is relatively little advantage in using dehulled seed and increasing sowing rates above 20 kg/ha. In view of the yields obtained and sulla's palatability (Kernick, 1978), the species should receive more attention as a special purpose forage crop in New Zealand.

ACKNOWLEDGEMENTS

Mr A.G.Foote for valuable assistance throughout the study; Plant Materials Group technicians and field staff for harvests and dissections.

REFERENCES

Kernick, M.D. 1978. "Ecological Management of Arid and Semi-arid Rangelands in Africa and the Near and Middle East". 4: 599-619. FAO, Rome.

Restuccia, G. 1974. *Tec. Agric. 28:* 3-16.

Watson, M.J. 1982. N.Z. *agric. Sci. 76:* 189-193.

Whyte, R.O.; Milsson-Leissner, C.; Trumble, H.C. 1953: *FAO Agric. Studies 27: 278-279.*

Table **1:** EFFECT OF SOWING RATE AND HULLING SEED ON ESTABLISHMENT, GROWTH AND SEED YIELD OF SULLA

Treatment: Hulling	Sowing Rate	Plants/m² (day 55)	Cover (arcsine percent) (day 64)	Canopy Height (cm) (day 80)	Stem Diameter (cm) (day 126)	First Flowering (days) --	Leaf/Stem Vegetative (day 170)	Leaf/Stem Flowering (day 170)	Yield Seed (kg/ha) (day 179)	Yield Forage (t/ha) (day 179)
Unhulled	**20**	74.3	16.4	24.9	0.69	90.5	0.49	0.39	116.8	13.7
(hull	40	143.0	26.3	26.4	0.66	89.2	0.48	0.39	154.1	17.0
present)	60	199.3	30.3	28.6	0.62	91.7	0.46	0.42	150.6	18.6
Dehulled	**20**	151.3	27.5	28.7	0.71	88.2	0.53	0.44	195.6	14.4
(hull	40	271.0	47.8	31.4	0.70	88.5	0.54	0.42	150.7	14.3
removed)	60	347.0	41.3	30.4	0.72	87.5	0.50	0.41	110.8	14.5
LSD (5%)'		44.9	6.0	2.5	NS	**3.9**	NS	**NS**	**NS**	**NS**
LSD (5%)'		51.8	14.0	6.2		4.5				

[1], [2] for differences between hulling treatments for the same ([1]) and different sowing rates ([2]). NS not significant.