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EFFECT OF SOWING RATE OF GLYCINE AND GREEN PANIC MIXTURES ON ESTABLISHMENT AND SURVIVAL UNDER DRY CONDITIONS

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SUMMARY

The effect of varying the seeding rates of Tinaroo glycine (*Glycine javanica*) and green panic (*Panicum maximum* var. *trichoglume*) on the establishment and survival of populations of both species was studied in an area which receives a mean annual rainfall of 27·76 in. The soil was a dry phase of a normally fertile alluvial clay loam.

Plant density of each species was dependent solely on the seeding rate of that species. There was no evidence of inter-species competition under conditions where neither species made sufficient growth to warrant yield samplings during the 2½ years of observations. Sparse stands of both species were present at the conclusion of the study, though green panic at lower planting rates showed an increasing plant density. The glycine stand was gradually declining at all planting rates.

I. INTRODUCTION

Of the more recently introduced subtropical and tropical pasture plants, one of the most valuable on fertile soils is glycine (usually known as *Glycine javanica* L.). A wide range of this species has shown considerable promise in nurseries on alluvial soils of the Callide Valley in Central Queensland. In early field plantings of the cultivar Tinaroo, slow early growth and poor persistence occurred. In line with the reports of Codd and Myburgh (1949) and Tow (1960), it appeared that most mortalities occurred in the seedling year, but no critical data were available to confirm or reject this.

The experiment reported here was designed to study the effects of competition on glycine establishment by varying the seeding rates of both glycine and the companion grass.

II. MATERIALS AND METHODS

The experiment was located at Biloela Research Station (lat. 24° 24′S., long. 150° 30′E.) at an elevation of 568 ft above mean sea level. The mean annual rainfall is 27·76 in. and the mean daily maximum temperature ranges from 70·9°F in July to 92·5°F in January. Mean daily minimum temperature ranges from 39·8°F in July to 67·5°F in January. The soil is a grey brown clay loam of alluvial origin.

A 20 x 4 randomized block design was used, with three blocks located on a light-textured, poorly structured, more arid phase with a slight slope and the fourth on a slightly moister, fairly level situation.

All combinations of the following Tinaroo glycine and green panic (*Panicum maximum* var. *trichoglume* (K. Schum.) Eyles) sowing rates were used:

Glycine 2 lb/ac Glycine 4 lb/ac Glycine 8 lb/ac Glycine 16 lb/ac	X	Green panic Nil Green panic 0·5 lb/ac Green panic 1 lb/ac Green panic 2 lb/ac Green panic 4 lb/ac

Plots were contiguous and measured 30 lk x 30 lk. After appropriate rhizobium inoculation of the glycine seed, the legume and grass seeds were mixed with sawdust and hand-broadcast. Sowing commenced in overcast weather on March 9, 1962, following 1·50 in. of rain during the previous week. Only one block was planted before heavy rain interfered, and planting was completed on March 11. Seed in the first block was not covered, but a mechanical pronged weeder was used to cover the seed in the last three blocks. The plants were grown entirely on rainfall, which was above average for April and May and slightly above average over the 7 months after planting—10·31 in. against an average of 9·53 in.

At no stage was sufficient growth made to justify yield sampling. However, the area was grazed on a number of occasions over the following 3 years. Counts of both glycine and green panic plants were made on three occasions. On May 1, 1962, two observers each counted one 21 in. x 42 in. quadrat per plot. On October 29, 1962, and October 14, 1964, two observers were again used, with a 5 x 2 lk quadrat counted two and three times per plot per observer respectively.

III. RESULTS

Plant counts are shown in Tables 1 and 2.

Glycine density was sensitive only to glycine seeding rate, the highest rate giving highly significant increases in density over all other treatments.

TABLE 1

SURVIVAL OF GLYCINE PLANTS BETWEEN MAY 1962 AND OCTOBER 1964

Treatment	Mean Number of Plants/100 sq lk			Percentage Survival (Derived)	
	1.v.62	29.x.62	14.x.64	242 days	957 days
A1 Glycine 2 lb/ac ..	6·3	3·9	2·2	61	34
A2 Glycine 4 lb/ac ..	8·4	8·1	3·2	97	38
A3 Glycine 8 lb/ac ..	16·3	14·4	4·1	89	25
A4 Glycine 16 lb/ac ..	40·9	25·3	4·3	62	11
B0 Green panic 0 lb/ac	20·3	14·3	2·9	70	14
B1 Green panic ½ lb/ac	15·6	14·2	4·3	91	28
B2 Green panic 1 lb/ac	16·4	11·6	4·7	71	28
B3 Green panic 2 lb/ac	18·9	10·8	2·8	57	12
B4 Green panic 4 lb/ac	18·7	13·5	2·3	72	12
Significance	A4>>A3 A3, A4>>A1, A2	A4>>A3 A3, A4>>A1, A2	Not Analysed	..	..

TABLE 2

SURVIVAL OF GREEN PANIC PLANTS BETWEEN MAY 1962 AND OCTOBER 1964

Treatment	Mean Number of Plants/100 sq lk			Percentage Survival (Derived)	
	1.v.62	29.x.62	14.x.64	242 days	957 days
A1 Glycine 2 lb/ac	13·5	11·7	11·4	87	85
A2 Glycine 4 lb/ac	11·3	13·5	8·8	119	78
A3 Glycine 8 lb/ac	9·8	13·4	10·2	137	104
A4 Glycine 16 lb/ac	9·1	9·2	9·8	101	108
B0 Green panic 0 lb/ac	0	0	1·7		
B1 Green panic ½ lb/ac	2·5	4·2	6·2	168	257
B2 Green panic 1 lb/ac	7·3	6·2	8·3	88	115
B3 Green panic 2 lb/ac	10·3	13·8	9·9	132	96
B4 Green panic 4 lb/ac	29·4	27·9	16·7	95	57
Significance	B4>>B1, B2, B3 B3>B1	B4>>B1, B2, B3 B3>B2	B4>>B1, B2, B3 B3>B1		

Green panic density was sensitive only to green panic seeding rate, with again a highly significant increase in stand density resulting from the highest seeding rate (4 lb/ac), an effect which persisted until the end of the trial.

There is a strong suggestion in the data that the percentage mortality of green panic was proportional to the initial seeding rate of the grass. The final

stand represented only 57% of the initial count at the heaviest rate but the lowest two seeding rates recorded an actual increase in stand. This trend was not established for glycine, which showed a gradual decline throughout the duration of the trial.

IV. DISCUSSION

In the plant introduction nursery at Biloela, with widely spaced rows and clean cultivated inter-rows, the various glycine cultivars grow particularly well, showing considerable promise as potential pasture species. Field performance, however, has been much more erratic. In isolated cases with better water relations, adequate levels of growth were obtained. In the present experiment three blocks were found to be on a particularly dry phase of this normally quite fertile soil. Here even the well-adapted green panic failed to achieve much growth. However, there were no significant differences between blocks in the populations recorded even though visually better growth occurred on the lower-lying fourth block of the experiment.

Despite the generally harsh conditions, 34% of the initial population of glycine planted at 2 lb/ac and 11% of the heaviest rate (16 lb/ac) population were still present 2½ yr later, though the glycine stand steadily declined over the full period of observations. The stands of glycine and green panic were solely dependent on their own planting rates, there being no evidence of inter-species competition.

Tow (1967) reported on a similar experiment on the fertile basaltic soils of the Atherton Tablelands (lat. 17° 17′ S., elevation 2,466 ft. above mean sea level; mean annual rainfall 53·99 in.). Under the much more favourable environment than at Biloela, there was a vigorous early growth of green panic and weedy species (absent at Biloela), which cause major mortalities in the glycine populations, especially in the first year.

Two years after planting and subsequent to the initial strong competition from the green panic, Tow still had 6–11 glycine plants per 100 sq lk, compared with 2–4 plants at Biloela 2½ yr after planting. On the other hand, green panic stands were vastly different. These finally were 60–100 plants per 100 sq lk on the Atherton Tableland but only 6–16 plants under the much drier conditions at Biloela.

Initial plant densities at Biloela were much lower than those reported by Tow. This may be accounted for in part by the fact that an extra 20 days elapsed before the first stand count was made, while no supplementary irrigation was used at this stage at Biloela.

The results of the two centres taken together would suggest that, in regard to both establishment and persistence, glycine plants are more susceptible to competition for factors other than moisture. At Biloela there was little if any

competition for light, which would have been considerable in Tow's experiment despite frequent mowing. Tow also indicated that the two species compete strongly for available nitrogen. At Biloela, lack of moisture would have restricted competition in this direction.

The ideal seeding rate for the quality of green panic seed used in the present trial appears to have been between 1 and 2 lb/ac. A build-up in plants from self-sown seed occurred where the seeding rate was lower. A decline in stand occurred at the higher rates.

V. ACKNOWLEDGEMENTS

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