years of sub-normal rainfall, the effect of anti-transpirants and moisture conservation by tied-ridging was observed.

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EVALUATION OF MAIZE AS FODDER AND GRAIN INTERCROP IN LUCERNE STAND

N. SANKARAN[1] and S. SANKARAN[2]

Field experiments were conducted during 1980-82 at the experimental farm of Tamil Nadu Agricultural University, Coimbatore, to study the possibility of raising intercrops in lucerne (*Medicago sativa* L.) and the effect of N and P application. The treatments consisted of pure lucerne, pure fodder maize, pure grain maize and lucerne plus fodder maize/grain maize association. To the mixed stand, nine combinations of three levels each of N and P (0 30 and 60 kg N/ha 0, 12.5 and 25 kg P_2O_5/ha) to maize fodder crop, (0, 60 and 120 kg N/ha and 0,30 and 60 kg P_2O_5/ha) to grain maize were applied. Lucerne + fodder maize association produced 45.9 and 37.7 per cent higher total DMP/year than pure lucerne and pure fodder maize respectively. Lucerne+ grain maize stand resulted in 30.9 per cent higher DMP/year than pure lucerne The reduction in the total DMP/year in lucerne+grain maize stand is only 4 per cent as compared to pure grain maize.

Associate Professor and Head, Dept. of Agronomy, Veterinary College, Madras-7.
Director, Soil and Crop Management Studies, TNAU, Coimbatore-3

Very often the fodder needs of livestock in the farms are met mostly through crop residues like dry straw. The nutritional value of this kind of fodder is not satisfactory. Feeding green fodder along with dry fodder is preferable, especially for milch animals. In most of the farms dry fodder is available throughout the year. Cultivating annual legumes as intercrops will not serve the purpose of supplying legume green fodder throughout the year. Hence by raising a perennial legume the problem can be solved. At the same time cereal green fodder is also essential for balanced nutrition. Growing a legume and cereal fodder in separate fields will entail allocation of larger area for fodder cultivation. Hence the usefulness of the inter-cropping system has to be explored. Growing lucerne alone or lucerne plus cereal fodder may not look attractive to the farmer as compared to the possibility of growing a grain crop. A mixture of lucerne plus a grain crop will meet the dual needs of fodd and fodder. With this view, fodder maize and grain maize were selected as the intercrops in the lucerne stand.

REVIEW OF LITERATURE

Frasser and Vartha (1980) working on grass+legume mixtures under irrigated conditions obtained an yield of 4.1 t of lucerne and 6.1 t of *phalaris* grass/ha on dry weight basis, when they were raised in association. Shanmugasundaram (1980) reported that the association of Napier-Bajra and grass lucerne accounted for the highest green forage and dry matter yield than pure stands of either crop. Marty and Eychenne (1980) noted greater dry matter yield in the maize/soybean mixed stand of forage crops.

Gunasena *et al.*, (1979) reported that intercropping legumes with maize reduced the grain yield of maize, but with added N, the reduction in yield could be minimised. Lima and and Majra (1979) observed increased total yield per unit area even through there was reduction in yield of maize or bean in the mixed stand. Kang *et al*, (1980) studied that when maize was grown in 4 metre width alleys between Leucaena hedges, a grain yield of 3.8 t/ha/year was obtained (with no nitrogen) along with 5 to 8 t dry tops of leucaena/ha. Andrade *et al.*, (1981) observed that plant population and season had agre ater influence in deciding the yield of maize + bean mixed stand.

MATERIALS AND METHODS

Field experiments were conducted at the experimental farm of Tamil Nadu Agricultural University, Coimbatore to study the possibility of raising maize as fodder and grain intercrops in a lucerne stand and the influence of N and P applications. The treatments consisted of pure lucerne, pure fodder maize, pure grain maize and lucerne plus fodder maize/grain maize association. Variates used were lucerne Co.1, maize Ganga-5 (F_1) and UMC-6. For lucerne Co. 1, 25-100-40 kg NPK/ha/year was applied and the entire

quantity of fertilizers were applied as a basal dose. For pure Maize fodder and grain crops, 60-25-20 kg NPK/ha/ crop and 120-60 60 kg NPK / ha / crop respectively were applied.

P and K were applied at the time of sowing. Nitrogen was applied in two equal splits at the time of sowing and at 30 days after sowing for intercrops The intercrops were given fertilizers as per the treatments (viz. 0. 30 and 60 kg N/ha/ crop 0, 12 5 and 25 kg P_2O_5 / ha/crop for fodder maize and 0, 60 and 120 kg N / ha / crop and 0.30 and 60 kg P_2O^5 /ha/crop for grain maize respectively.

For pure lucerne solid rows spaced at 30 cm between rows was followed. For the intercrop system lucerne was sown in paired rows of 45 + 15 cm. Lucerne seeds were treated with bacterial inoculum of *Rhizobium* spp. The fodder maize was sown continuously in the lucerne rows in the 45 cm space. The grain maize crop was sown in the inter-row space of lucerne with a plant spacing of 30 cm. Pure crop of maize grain was sown with a spacing of 45x30 cm. The intercrops were sown after the first cut of lucerne was taken at 60 days after sowing. The experiments was laid out in a factorial randomised block design with four replications.

RESULTS AND DISCUSSION

The data recorded on percent contribution of lucerne to total dry matter and green matter production of the mixed stand and per day production are presented in Table-1.

Total dry matter production in lucerne -grain maize/fodder maize stand

Pure crops of lucerne, grain maize and fodder maize recorded dry matter production 38.42 52.22 and 37.10 t/ha / year respectively. Application of N significently decreased the total dry matter production in the mixed stands of lucerne grain maize whereas the dry matter yield of lucerne-fodder maize was significantly increased by N application.

The effect of P application on total dry matter production of mixed stand was not significantly in lucerne-grain maize combination, but significant in lucerne-fodder maize stand. In the latter case, application of p at 12 5 and 25 kg ha increased the total dry matter yield to53 3 and 55 9 t/ha respectively as compared to 52.1 t/ha with no phosphorus.

In general, it could be seen that application of N and P fertilizers was beneficial in producing higher dry matter yield of lucerne+fodder maize mixed stand, but lucerne+grain maize stand was not benefited by fertilizers.

It has earlier been observed that the dry matter yield of lucerne in a mixed stand with grain/fodder maize has been significantly reduced due to N and P application (Gunasena

et al, 1979). The yield of dry matter from both grain and fodder maize was increased by N and P fertilization. The differential trend in the total dry matter production of the two mixed stands with N and P application could only be due to the greater increase in fodder maize yields than in grain maize. The increase in dry matter production of grain maize was not sufficient enough to compensate for the reduction in the lucerne yield when N and P were applied to the mixed stand of lucerne + grain maize.

Table 1 Total dry matter production, per cent contribution by lucerne and per day production (1981-82)

Character	Total DMP (t/ha/year)		Percent contribution by lucerne			Per day proudction (kg/ha)	
Treatments	L+M(G)	L+M(F)	L+M(G)	DMP L+M(F)	Forage L+M(F)	L+M(O)	L+M(F)
Lucerne	38.42	38.42	—	—	—	98.5	98.5
M(G)/M (F)	52.22	37.10	—	—	—	133.9	95.1
L+M (G)/M(F)	50.27	53.78	47.10	58.39	56.11	128.9	137.9
SED	0.66	0.80	—	—	—	1.7	2.3
CD (P=0.05)	1.35	NS	—	—	—	3.7	NS
N_0	51.25	52.77	49.42	61.83	59.83	131.4	135.6
N_1	50.41	53.78	47.17	58.58	56.08	129.4	137.9
N_2	49.15	54.80	44.83	54.75	52.42	126.0	140.5
SED	0.38	0.46	0.29	0.45	0.43	1.0	1.3
CD (P=0.05)	0.78	0.94	0.59	0.92	0.89	2.0	2.7
P_0	50.53	52.12	48.58	59.50	56.83	131.4	133.6
P_1	50.50	53.53	47.67	57.92	55.92	130.1	136.7
P_2	49.78	55.90	45.17	57.75	55.58	127.6	143.3
SED	0.38	0.46	0.29	0.45	0.43	1.0	1.3
CD (P=0.05)	NS	0.94	0.59	0.92	0.89	2.0	2.7
N x P	NS	NS	NS	NS	NS	S	NS

NS - Not significant
M (G) - Maize Grain
M (F) - Maize Fodder
S - Significant

Percent contribution of lucerne to total dry matter production of lucerne+grain maize :

Lucerne was able to contribute only 47.1 per cent to total dry matter production of lucerne plus grain maize. This implies that grain was the dominant component of the association as indicated by its share of 52.9 per cent of total dry matter production.

The contribution of lucerne was further reduced by the application of N and P fertilizers to the mixed stand of lucerne and grain maize. The grain maize crop was able to perform relatively better under fertilized condition than with no fertilizer. The relative contribution of lucerne to total dry matter production was reduced from 49.4 per cent under no nitrogen to 47.2 and 44.9 per cent with the application of 60 and 120 kg N/ha respectively. On the other hand the contribution of maize was increased by 2.3 to 15.0 percent over the control due to N levels.

In the absence of P fertilizer, lucerne's production was 48.6 per cent of the total, whereas with 30 and 60 kg P_2O_5 /ha applied, the contribution of lucerne was reduced to 47.7 and 45.2 percent respectively As in the case of N application, the levels of P fertilizer also helped to increase tne relative share of grain maize to total dry matter production by 0.9 to 3.4 per cent.

Per cent contribution of lucerne to total dry matter production of lucerne + fodder maize

Lucerne was able to contribute relatively a larger proportion of the dry matter yield (58.4 per cent) in the mixed stand of lucerne + fodder maize than in lucerne + grain maize This indicates the dominance of lucerne over fodder maize in such a mixed stand. Lower grass yield and greater contribution by clover was reported by Camlin (1981) in a grass+legume sward.

However application of N and P fertilizers reduced the share of lucerne to the total dry matter production. The reduction in the percent contribution of lucerne due to N application ranged from 3.3 per cent for 30 kg N/ha to 7.0 per cent for 60 kg N/ha. The order of reduction due to P application was comparatively lesser i.e 1.58 and 1.75 percent with 12.5 and 25 kg P_2O_5 /ha respectively. The decrease in lucerne contribution due to fertilizer application was compensated by a corresponding increase in the relative contribution of fodder maize to the total dry matter production. This is in accordance with Camlin (1981) who reported similar total annual yields in grass+clover mixture at a moderately high level of N. Even at the highest level of fertilizer application the percent contribution to dry matter production by fodder

maize was lesser (45.3 and 42.2 per cent for N and P) than that for lucerne.

Per cent contribution of lucerne to green matter production of lucerne + fodder maize :

Relatively larger proportion of the green forage yield of lucerne plus fodder maize association was obtained through lucerne (56.1 per cent). This again signifies the dominance of lucerne over fodder maize in mixed stands. Camlin (1981) reported that certain rye grass cultivars consistently produced lower grass yields and consequently permitted greater clover contribution.

However application of N and P fertilizers reduced the share of lucerne to total forage yield. The reduction in the contribution of lucerne due to N application ranged from 3.8 percent for 30 kg N/ha to 7.4 per cent for 60 kgN/ha. The order of reduction due to P application was relatively lesser i. e. 0.9 to 1.3 per cent with 12.5 and 25 kg P_2O_5 /ha respectively. The decrease in lucerne contribution due to fertilizer application was matched by a corresponding increase in the relative contribution of fodder maize to total forage yield. Camlin (1981) observed that in grass+clover association although with minor exceptions total annual yields were similar in the mixtures at the moderately high level of N. However even at the highest level of N and P applied the contribution of fodder maize was lesser than that of lucerne.

Per day production :

Dry matter production per dry was of the order of 98.5 kg. 133.9 kg and 95.1 kg for pure crops of lucerne, grain maize and fodder maize respectively. When grown in mixed stand the per day production was increased over pure lucerne or pure fodder maize but was lesser than pure grain maize. The effect of fertilizer application on per day production of dry matter followed a similar pattern as that for total dry matter production per year.

CONCLUSION

The results indicated that the grain maize was the dominant component of the association with or without fertilization. The same trend was reflected in the fodder maize+lucerne stand. But the reduction in lucerne yield was componsated for by the correspoinding increase in the fodder maize production. The per day production of dry matter was the highest i. e. 137.9 kg with lucerne plus fodder maize stand.

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