

## STUDIES ON THE ASSOCIATION OF PERENNIAL GRASS (NB-21) LEGUME (LUCERNE) MIXTURE ON THE FORAGE YIELD AND QUALITY.

*III Plant growth, tiller production, Shoot-root ratio and leaf area index*

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The results revealed that the growth attributes of grass as pure and as mixture (grass + legume) were not materially altered by the inter cropping of lucerne. Nitrogen and phosphorus had less influence in the mixture. Nitrogen caused a positive response in shoot-root ratio N and P had no effect in increasing the LAI in grass-legume mixture.

There appears to be nothing better than mixed cropping of protein rich leguminous crops with grasses or cereals for getting high yield of nutritious fodder. More over, application of fertilizer to these mixed fodders is gaining popularity. The demand, however is more for nitrogenous fertilizers. Judicious application of these fertilizers will increase both the quality and quantity of fodder mixture. The present investigation was taken up to study the performance of biometric characters of grass + legume, when they are grown in association and the response to fertilizer application.

### MATERIALS AND METHODS

The experiment was conducted during two consecutive years of 1976-77 and 1977-78. The treatments consisted of pure crop of lucerne (R1), NB-21 grass (R2), NB-21 grass + lucerne in alternate rows (1:1) (R3) and NB-21 grass + lucerne in 2:1 rows (R4) with nitrogen levels 0, 20, 40 kg N/ha/cut and P<sub>2</sub>O<sub>5</sub> levels 0, 50, 100 kg/ha/year. The experiment was undertaken at the Tamil Nadu Agricultural University, Coimbatore. Randomised block

design was adopted with three replications. The seed rate adopted was 40,000 slips/ha. For lucerne a seed rate of 15 kg/ha was adopted. Leaf area index was determined by measuring the length and maximum width of five representative leaves and factor 0.75 was used and calculated per unit area of land (Winter and Ohlrogge, 1973; Gomez and Palanisamy, 1974). The spacing adopted for grass was 60 cm between rows and 40 cm within rows. Pure crop of lucerne was sown by adopting a spacing of 30 cm between rows. The crop was harvested at 30 days interval and bio-metric characters like plant growth, tiller production, shoot - root ratio and leaf area index were recorded.

### RESULTS AND DISCUSSION

#### Height of grass

The data on the grass height of pure stand (R2) and mixed stand (R3) and (R4) are presented in Table 1. The height of the grass was less during the dry weather and north east monsoon season. It was maximum during south west monsoon and hot weather season.

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However the effect of N was noticed with high dose of N from second season onwards. The effect of P was not significant (Tiwari, 1966). Grass-legume mixture fertilized with N at different rates differ in their response to applied N (Reid, 1961). Similar trend was indicated in the present study also. In the later stages, there was no additional growth by application of fertilizer N. The height of grass was also not altered by the intercrop lucerne.

#### Height of Lucerne

Height of lucerne in pure stand (R1), mixed stand and 1:1 row (R3) and 2:1 row (R4) are presented in Table. 2. The height of lucerne increased when grown as pure crop during the first five seasons. As inter crop either alternatively (R2) or with highest proportion of grass (R1) there was no significant difference. When lucerne was sown as sole crop (R1) there was no competition from other species. On the other hand, when grown as intercrop in R3 and R4 where the grass height ranged between 105.3 to 152.8 cm at different seasons, the availability of solar radiation would have been reduced to the low level. This could have made the lucerne crop to grow taller in 1:1 row (R3) and 2:1 row (R4) in search of sunlight. The beneficial effect of application of N and P in RT and R4 has not been indicated in height

#### Production of Tillers in grass

Tiller production per clump of pure grass (R1) and grass grown in 1:1 row (R3) and 2:1 (R4) are presented in table 3. Number of tillers in case of pure crop (R2) was 33.8 for the dry weather

season and increased to 84.2 during south west monsoon. As the age of crop advanced there was gradual drop in the tiller production. There was reduction in second year also. The increased growth of lucerne inter crop in 1:1 row (R3) and 2:1 row (R4) restricted the vertical growth of grass. This would have facilitated compensatory growth by way of increased tiller production. However, the differences between mixtures at all stages were not significant. Application of either N or P was found to be beneficial only in two seasons in second year.

#### Shoot-Root Ratio

The data on the effect of lucerne as intercrop on the shoot-root ratio of grass in pure stand and in mixture are presented in table. 4. It could be seen from the table that the shoot-root ratio of the grass was not altered by growing lucerne as an intercrop in first and second year.

#### Leaf Area Index of Grass

The data on leaf area index of grass in pure and mixed stand are presented in table 5. In the present study the effect of N and P was not felt with the addition of fertilizer N, the differences narrowed down to non significant level. The effect of climate also was not noticed in mean LAI. The LAI was the highest during south west monsoon followed by north east monsoon season. During these periods, the rainfall was adequate and well distributed with warm temperature. In general pure crop of grass recorded increased LAI than 1:1 row (R3) and 2:1 row (R4). The growth rate measured in terms of LAI was

Table 1. Plant height of grass in relation to fertilizers treatments

Fertilizer leaves	1		2		3		4		5		6		7	
	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>
N <sub>s</sub>	108.7	106.1	132.8	130.2	148.1	151.7	107.7	111.2	135.6	131.9	153.7	148.9	137.8	126.0
N <sub>t</sub>	104.6	104.1	140.6	139.2	147.3	148.7	114.7	110.0	134.4	130.7	149.5	145.2	128.5	127.4
N <sub>s</sub>	106.1	105.7	133.6	137.8	160.9	158.0	123.1	120.8	142.9	139.3	152.4	147.4	133.0	124.3
P <sub>s</sub>	107.9	102.4	139.2	137.0	150.1	153.7	115.5	111.5	137.1	132.5	146.9	140.2	131.7	121.6
P <sub>t</sub>	106.8	107.5	134.5	136.1	153.3	149.7	119.3	113.4	137.6	131.7	151.8	149.0	131.9	130.4
P <sub>s</sub>	106.4	106.0	133.4	134.1	152.8	155.7	110.7	117.1	138.2	137.7	156.9	142.3	135.6	125.8
Mean	107.0	105.3	135.7	135.7	152.1	152.8	115.1	114.0	137.6	133.9	151.8	147.1	133.1	125.9
R <sub>s</sub>	123.6		139.4		144.6		118.1		138.5		156.8		131.6	

S.E.D./C.D.

R <sub>s</sub> Vs R <sub>t</sub> or R <sub>t</sub>	4.6	9.3	6.2	12.6	3.2	6.4	4.8	9.9	4.9	9.9	6.7	13.6	9.1	18.5
R <sub>s</sub> Vs R <sub>t</sub>	2.0	N.S.	2.7	5.6	1.4	2.9	2.1	4.4	2.1	4.4	3.0	6.1	4.0	8.2
R X N	3.5	N.S.	4.8	N.S.	2.4	N.S.	3.7	N.S.	3.8	N.S.	5.2	N.S.	7.0	N.S.
N X P	3.5	N.S.	4.8	N.S.	2.4	N.S.	3.7	N.S.	3.8	N.S.	5.2	N.S.	7.0	N.S.

Table-2 Plant height lucerne in relation to fertilizer treatments CM

Season fertilizer levels	1		2		3		4		5		6		7	
	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>
No	64.6	60.7	86.0	84.8	82.7	82.7	96.1	95.7	91.8	88.3	85.1	83.7	70.1	72.9
N <sub>1</sub>	59.7	60.5	90.1	87.6	84.8	84.7	98.0	100.0	89.5	92.3	84.6	86.7	77.8	77.5
N <sub>2</sub>	63.9	62.9	89.7	89.4	85.2	85.9	102.6	99.6	91.7	89.1	87.6	85.4	76.2	77.4
P <sub>0</sub>	60.5	61.6	89.7	86.7	82.6	83.2	98.2	93.4	89.9	88.3	84.0	83.7	70.2	72.0
P <sub>1</sub>	61.7	59.9	87.8	85.7	86.0	84.8	97.4	100.9	90.8	83.2	85.6	85.9	73.6	76.9
P <sub>2</sub>	66.0	62.6	88.3	89.4	84.2	85.3	100.0	100.0	92.3	88.3	88.0	85.9	80.3	78.9
Mean	62.7	61.3	88.6	87.2	84.2	84.4	98.8	98.4	91.0	89.9	85.8	85.2	74.7	75.9
R	79.9		77.9		81.0		88.1		88.6		85.0		71.5	

S.E.D / C.D.

R <sub>1</sub> Vs R <sub>2</sub> or R <sub>3</sub>	2.9	6.0	2.0	4.1	2.2	6.0	2.7	5.6	3.2	6.5	3.0	6.2	4.9	10.0
R <sub>2</sub> Vs R <sub>3</sub>	1.3	N.S.	0.9	N.S.	1.3	N.S.	1.2	N.S.	1.4	N.S.	1.3	N.S.		N.S.
R x N	2.3	N.S.	1.5	N.S.	2.3	N.S.	2.1	N.S.	2.5	N.S.	2.3	N.S.	2.2	N.S.
R x P	2.3	N.S.	1.5	N.S.	2.3	N.S.	2.1	N.S.	2.5	N.S.	2.3	N.S.	2.2	N.S.

Table 3. Production of tillers in relation to fertilizers treatments-Grass (Number/clump)

Seasons fertilizer levels	1		2		3		4		5		6		7	
	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>	R <sub>s</sub>	R <sub>t</sub>
N <sub>0</sub>	37.0	36.0	66.1	63.4	78.2	81.9	65.2	65.3	51.6	52.7	53.7	60.9	45.6	47.5
N <sub>1</sub>	37.8	37.4	80.6	79.5	86.0	87.3	69.6	70.7	57.0	53.4	72.2	67.7	50.0	42.3
N <sub>2</sub>	37.8	38.7	82.5	81.2	86.0	101.6	70.2	84.8	58.3	57.4	73.2	79.1	46.3	45.9
P <sub>0</sub>	36.0	37.0	78.3	75.3	77.7	89.1	66.8	72.7	55.2	55.5	63.3	66.7	46.1	45.9
P <sub>1</sub>	36.5	37.8	72.5	72.1	85.7	88.0	68.5	71.1	56.7	51.5	70.2	67.6	45.3	43.4
P <sub>2</sub>	40.1	37.3	78.4	76.8	80.7	93.7	69.7	77.1	55.0	56.5	65.6	73.4	49.3	46.4
Mean	37.5	37.3	76.4	74.7	81.3	90.2	68.3	73.6	55.6	54.5	66.0	69.2	46.9	45.2
R <sub>1</sub>	33.8		60.4		84.2		59.8		51.8		71.5		51.5	

S. ED./C.D.

R <sub>1</sub> Vs R <sub>2</sub>	2.7	N.S.	8:1	N.S.	5.5	N.S.	3.1	6.2	2.8	N.S.	5.4	N.S.	2.8	5.7
R <sub>2</sub> Vs R <sub>3</sub>	1.2	2.4	3.6	7.3	2.4	5.0	1.3	2.8	1.2	2.6	2.4	N.S.	1.2	2.5
R X N	2.1	N.S.	6.3	N.S.	4.3	N.S.	2.4	4.8	2.2	N.S.	4.1	N.S.	2.2	4.4
R X P	2.1	N.S.	6.3	N.S.	4.3	N.S.	2.4	4.8	2.2	N.S.	4.1	N.S.	2.2	4.4

Table 4 Shcot - Root ratio

Fertilizer level	1st year		IInd year	
	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>
N <sub>0</sub>	6.7	6.4	6.0	5.0
N <sub>1</sub>	9.3	8.2	6.8	5.8
N <sub>2</sub>	9.1	8.0	7.4	5.9
P <sub>0</sub>	9.5	8.1	6.3	5.7
P <sub>1</sub>	8.4	7.3	6.1	5.6
P <sub>2</sub>	7.2	7.2	7.8	5.4
Mean	8.3	7.5	6.7	5.6
R <sub>2</sub>	8.2		6.3	
S. E. D / C. D.				
S <sub>2</sub> Vs R <sub>3</sub> or R <sub>4</sub>	0.3	0.6	0.4	N.S
R <sub>3</sub> Vs R <sub>4</sub>	0.3	0.6	0.4	0.8
R x N	0.9	N.S	0.6	N.S
R x P	0.9	N.S	0.6	N.S

Table 5 Mean LAI of grass at different seasons

Season	Mean LAI			S. E. D / C. D.	
	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>2</sub> Vs R <sub>3</sub> or R <sub>4</sub>	R <sub>3</sub> Vs R <sub>4</sub>
1	29.42	28.50	30.94	3.27/N S.	1.46/2.96
2	28.26	28.05	26.90	5.37/10.87	2.40/4.86
3	52.05	36.25	32.66	8.63/17.48	3.86/7.82
4	41.52	41.94	42.18	9.65/19.54	4.31/8.73
5	21.16	17.51	15.36	3.34/6.77	1.49/4.03
6	20.08	19.81	21.77	3.25/6.58	1.45/2.94
7	23.50	17.27	15.11	2.66/5.38	1.19/2.40

higher when mixed with lucerne irrespective of the proportions in the fourth season and in the higher proportion of grass in the first and sixth seasons. In other seasons the sole crop invariably recorded higher LAI. This is indicated by the competitive effect of the lucerne crop on the grass.

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