

Effect of planting pattern and nutrient management on yield and yield attributing characters of teosinte (*Euchlaena maxicana*) + ricebean (*Vigna umbellata*) intercropping

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ABSTRACT

The experiment conducted at Ranchi, during *Kharif* 1994 and 1995 to study the effect of planting pattern and nutrients management on forage production of teosinte [*Euchlaena maxicana* (L.) Schard] + ricebean [*Vigna umbellata* (thunb.) Ohwi & Ohashi] intercropping, indicated that teosinte grown in association of ricebean in 2 : 1 row ratio and fertilized with 75% of the recommended dose of nutrient (100% NPK : for teosinte 100 : 50 : 25 and for ricebean 30:60:25 kg/ha) produced significantly the highest green forage (245.70 q/ha) yield. However, the highest dry matter (41.46 q/ha) and crude protein (5.24 q/ha) yields were recorded from the treatment receiving 75 and 100% of the recommended dose of nutrient respectively under 2 : 1 row arrangement and they were significantly superior to rest of the combinations. The interaction effect of 100% of the recommended dose of nutrient with 2 : 1 row ratio planting pattern also produced maximum plant population. The higher levels (75% or 100%) of nutrients when combined with 1 : 2 stand of teosinte and ricebean recorded the highest plant height in ricebean and maximum number of tillers in teosinte and were significantly superior to rest of the treatment combination.

Key words : Planting pattern, Nutrient management, Teosinte, Ricebean, Intercropping

Availability of green forage to the animals is the key of successful dairy enterprises. Hence to meet the increasing demand of green forage, manipulation in cropping system is the only way out left over to the scientists, as the limited land area is devoted towards fodder crops due to pressure on the land for grain production. Intercropping seems to be an ideal method to increase forage production besides its other advantages (Willey, 1979 a) which enable

the farmers to have high tonnage of green forage *vis-a-vis* maintaining the soil fertility and nutrients economy in a better way.

MATERIALS AND METHODS

A field experiment was carried out during *kharif* 1994 and 1995 at the Birsa Agricultural University Farm, Ranchi, on a sandy loam soil having 0.55% organic carbon, 195.5 kg/ha available N, 12.77 kg/ha available P and 118.04 kg/ha available K. The soil

was acidic in nature having 5.9 pH. The amount of rainfall received between June and October in 1994 and 1995 was 1,617.2 mm and 1,596.3 mm, respectively. Three nutrient levels, viz. 100% (100 kg N + 50 kg P_2O_5 + 25 kg K_2O /ha for teosinte and 30 kg N + 60 kg P_2O_5 + 25 kg K_2O /ha for ricebean), 75% and 50% of the recommended dose of nutrients, and 6 planting patterns, viz. teosinte sole, ricebean sole, teosinte + ricebean (1 : 1), teosinte + ricebean (1 : 2), teosinte + ricebean (2 : 1) and teosinte + ricebean (2 : 2), were tried in a 3 times replicated split-plot design where nutrients management was kept in the main plots and planting pattern in subplots. Seeds and fertilizer for both the crops were used as per row ratio in each plot. A seed rate of 40.0 kg and 30.0 kg/ha of teosinte ('Sirsa') and ricebean ('RBL 1') respectively was used in a row spacing of 30 cm. In teosinte half dose of N and full dose of P_2O_5 and K_2O were applied at the time of sowing. Rest half dose of nitrogenous fertilizer was top-dressed at the tiller initiation stage between 2 rows. In case of ricebean entire dose of nutrients (N, P_2O_5 , and K_2O) was applied at the time of sowing.

RESULTS AND DISCUSSION

Growth and yield attributes

Plant population was not significantly influenced due to nutrients management (Table 1). The highest plant height (161.95 cm) and number of tillers (63.55/m row length) of teosinte were recorded at 75% of the recommended dose of nutrients. These attributes were statistically at par with the value obtained under 100% of the recommended dose of nutrients but they were significantly superior to the values of plant height and number of tillers recorded under

50% of the recommended dose of nutrients. Contrary to this, significantly the highest plant height (91.63 cm) of ricebean was recorded when the crop fertilized with 100% of the recommended dose of nutrients. Manohar *et al.* (1992) also found that the plant height, tillers/plant and leaves/plant increased significantly with increasing level of N in pearl millet. Similarly, the highest tillers (63.55/m row length) in teosinte was recorded with 75% of the recommended dose of nutrients which was statistically at par with the tillers obtained under 100% of the recommended dose of nutrients and they were significantly superior to the treatment receiving 50% of the recommended dose of nutrients. Planting patterns did not influence the plant population and the highest plant population (22.88/m row length) was recorded when teosinte was intercropped with ricebean in 2 : 1 row ratio. Ricebean showed the superiority in plant height (90.83 cm) and teosinte in number of tillers (73.40/m row length) under teosinte + ricebean in 1 : 2 row ratio (Table 1). Under 100% of the nutrients level at 1 : 2 row ratio of planting pattern of teosinte and ricebean the highest plant height (95.40 cm) was recorded in ricebean and it was statistically at par with the plant height either at 2 : 2 row ratio of teosinte and ricebean associations with 100% or 75% of the recommended dose of nutrients or 1 : 1 and 1 : 2 row ratios of teosinte and ricebean associations, respectively under same nutrient levels (Table 2). The maximum number of plant tillers in teosinte was obtained when the crops were sown in 1 : 2 row ratio under 75% of the recommended dose of nutrients which was statistically on par when the crop received 100% of the recommended dose of nutrients under same planting pattern and

Table 1. Plant population, plant height, tillers, green herbage, dry matter and crude protein yield of teosinte + ricebean associations as influenced by planting pattern and nutrient management (pooled data of 2 years)

Treatment	Plant population Number/m row length	Plant height (cm)		Tillers/m row length in teosinte at (80 DAS)	Green herbage yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)
		Teosinte 80 DAS	Rice-bean (75 DAS)				
<i>Nutrient management</i>							
100% of the recommended dose	20.27	159.89	91.63	62.21	194.43	34.12	4.02
75% of the recommended dose	21.63	161.95	87.32	63.55	190.62	33.78	3.89
50% of the recommended dose	20.13	141.05	79.16	52.21	152.53	27.61	2.53
CD (P = 0.05)	NS	16.61	2.57	3.82	0.82	1.36	0.32
<i>Planting pattern</i>							
Teosinte sole	22.25	152.20		58.02	159.76	27.17	1.93
Ricebean sole	21.28		81.62		125.35	23.84	3.28
Teosinte + ricebean (1 : 1)	18.21	144.60	84.08	57.38	186.84	32.66	3.54
Teosinte + ricebean (1 : 2)	19.66	150.05	90.83	73.40	181.12	31.26	3.60
Teosinte + ricebean (2 : 1)	22.88	167.17	81.23	53.07	225.29	38.42	4.64
Teosinte + ricebean (2 : 2)	20.88	157.47	89.42	54.75	196.80	37.65	3.90
CD (P = 0.05)	NS	NS	2.17	2.76	0.84	1.72	0.39

Table 2. Plant population, plant height, tillers, green herbage, dry matter and crude protein yield of teosinte+ricebean associations as influenced by planting pattern and nutrient management (pooled data of 2 years)

Treatment	Plant population (number/m row length)	Plant height (cm)		Tillers/m row length in teosinte at harvest (80 DAS)	Green herbage yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)
		Teosinte at harvest (80 DAS)	Ricebean at harvest (75 DAS)				
<i>100% NPK levels</i>							
Teosinte (sole)	20.10	161.20		51.80	178.74	29.73	2.28
Ricebean (sole)	19.75		80.15		125.36	24.35	3.53
Teosinte : ricebean							
1 : 1	18.98	154.15	93.35	61.90	203.70	34.79	3.93
1 : 2	18.78	159.00	95.40	73.80	198.70	35.05	4.51
2 : 1	25.37	161.25	85.35	54.80	238.57	40.15	5.24
2 : 2	21.94	163.45	94.90	60.75	221.49	40.65	4.62
<i>75% NPK levels</i>							
Teosinte (sole)	24.83	161.30		58.95	163.80	28.51	2.28
Ricebean (sole)	24.25		86.70		145.98	26.52	3.68
Teosinte : ricebean							
1 : 1	17.35	145.35	84.05	63.15	195.84	35.08	3.94
1 : 2	20.58	153.10	92.20	79.60	188.71	32.60	4.03
2 : 1	21.16	185.00	81.00	58.60	245.70	41.46	5.12
2 : 2	21.63	163.00	92.65	57.45	203.67	38.49	4.29
<i>50% NPK level</i>							
Teosinte (sole)	21.83	134.10		55.30	136.75	23.27	1.23
Ricebean (sole)	19.83		78.00		104.70	20.65	2.62
Teosinte : ricebean							
1 : 1	18.31	131.90	74.85	47.10	160.97	28.10	2.74
1 : 2	19.61	138.05	84.90	66.80	155.95	26.12	2.27
2 : 1	22.10	155.25	77.35	45.80	191.60	33.68	3.55
2 : 2	10.08	145.95	80.70	46.05	165.23	33.81	2.79
CD (P = 0.05)	7.78	NS	3.75	7.74	1.45	2.99	0.69

they were significantly superior to rest of the treatment combinations (Table 2).

Yield

Teosinte produced significantly the highest green forage yield (194.43 q/ha) with 100% of the recommended dose of nutrients which was 12.96 and 21.55% higher than the green forage obtained at 75 and 50% of the recommended dose of nutrients (Table 1). Teosinte intercropped with ricebean in 2 : 1 row ratio produced significantly the highest green forage yield (225.29 q/ha) with 12.65 and 17.07% higher than the planting patterns of teosinte + ricebean in 2 : 2 and 1 : 1 row ratio respectively. Pooled mean of 1994 and 1995 indicated that teosinte + ricebean (2 : 1) fertilized with 75% of the recommended dose of nutrients produced significantly the highest green herbage yield (245.70 q/ha) (Table 2). Nutrients management significantly influenced the dry matter and crude protein yields and the highest dry matter and crude protein yields of 34.12 and 4.02 q/ha, respectively, were recorded under 100% of the recommended dose of nutrients and they were statistically at par with the yields obtained under 75% of the recommended dose of nutrients. However, these yields were significantly superior to the yields obtained under 50% of the recommended dose of nutrients. Similarly, teosinte intercropped with ricebean in 2 : 1 row ratio produced the highest dry matter and crude protein yields of 38.42 and 4.64 q/ha, respectively, which were at par with the yields obtained under teosinte+ricebean in 2 : 2 row ratio and they were significantly superior to the yields obtained in rest of the planting pattern. Pooled mean of 1994 and 1995 indicated that teosinte + ricebean in 2 : 1 row ratio fertilized with 75% of the recommended dose of nu-

trients produced the highest dry matter yield (41.46 q/ha) and it was statistically at par with the yield received under teosinte + ricebean either in 2 : 1 or 2 : 2 row ratio receiving 100% of the recommended dose of nutrients. The highest crude protein yield (5.24 q/ha) was obtained when teosinte intercropped with ricebean in 2 : 1 row ratio and fertilized with 100% of the recommended dose of nutrients and it was statistically at par with the crude protein yield obtained under 100% and 75% of the recommended dose of nutrients when teosinte associated with ricebean in 2 : 2 and 2 : 1 row ratio respectively and they were significantly superior to rest of the treatment (Table 2). Manoharan and Subramanian (1993) and Jayanthi *et al.* (1994) also obtained higher green forage and crude protein yield in 2 : 1 row ratio of maize + cowpea.

Thus intercropping of teosinte+ricebean in 2 : 1 row ratio fertilized with 75% of the recommended dose of nutrients is the suitable practice for obtaining high yield of good quality forage under plateau region of Bihar.

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