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Nutrient economy and herbage productivity in oat (*Avena sativa*) + berseem (*Trifolium alexandrinum*) intercrop association

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ABSTRACT

A field experiment was conducted at Ranchi during the winter season of 1997–98 and 1998–99, to assess the nutrient economy and herbage productivity in 1:1 ratio of oat (*Avena sativa* L.) + berseem (*Trifolium alexandrinum* L.) intercropping system. Oat fertilized with 75% recommended dose of NPK + berseem at 100% NPK produced 41.2% and 58.6% more green herbage over sole stand (100% NPK) of oat and berseem respectively. The same also accounted for the highest net return (Rs 21,242/ha), net return/rupee investment (Rs 3.19/Re) along with almost similar monetary advantage when the both component species were grown at 100% NPK. The same treatment also gave better land-equivalent ratio (LER 1.69).

Key words : Herbage yield, Oat, Berseem, Intercropping, Nutrient level, Economics, Yield advantage

Intercropping of forage cereal and legume improves the quality of forage on one hand and the soil fertility on the other, besides it enhances the total biomass production/unit space and time (Choubey and Bhagat, 1998). Choubey *et al.* (2000) recorded a saving of 25% nutrient through intercropping of rainy *(kharif)*-season forages teosinte and ricebean which was also found economically more viable. On the same line, intercropping of 2 principal *(rabi) winter* forages, viz. oat and berseem, may be biologically and economically more sustainable than their sole stand with remarkable reduction in use of fertilizers. Keeping these objectives in view, an experiment was conducted to optimize the level of NPK nutrients for growing oat and berseem in intercrop association of 1:1 row ratio.

MATERIALS AND METHODS

The field experiment on 1:1 intercrop association of 'Kent' oat and 'Wardan' berseem with 5 different fertility levels was conducted during winter *(rabi)* seasons of 1997–98 and 1999–98 at Ranchi Veterinary College, Kanke, Ranchi. The soil was red

sandy loam (Alfisol) in texture (sand 55%, silt 27% and clay 18%) having high permeability and low water-holding capacity (25.5% at 0.3 bar and 9.5% at 1.5 bar), with pH 5.8. It was low in available N (195.82 kg/ha) and P (17.08 kg/ha) and medium in K (200.00 kg/ha).

The treatments consisted of 5 nutrient levels for each sole oat and oat+berseem, viz. control, 25, 50, 75 and 100% NPK and 1 sole berseem at 100% NPK. Thus total 11 treatments were put in randomized block design and replicated thrice. The plot size of 4.00 m × 2.75 m was kept and sowing of both the components was done at 25 cm row-to-row spacing. The 100% NPK of oat and berseem was 80:40:25 and 25:60:25 kg/ha respectively. The nutrients were applied as per row ratio. In oat, 50% N was applied basal and remaining in 2 equal splits, at tillering and boot stages whereas in case of berseem the entire nutrients were applied at the time of sowing.

The crop was sown in third week of November during both the years. Total 3 cuts of berseem were taken—first at 60 days after sowing and subsequent cuts at 30-day interval, whereas only 1 cut in oat could be taken, i.e. at 50% flowering stage.

Yield attributes of oat in sole as well as in mixed stand were recorded. Dry-matter yield was determined by drying the plant samples in hot-air oven at 40°C. Thus the total dry matter produced was calculated on the basis of green-herbage yield. Land-equivalent ratio (LER) and monetary advantage were computed as proposed by Willey (1979). Data were analysed statistically.

RESULTS AND DISCUSSION

Yield attributes

Nutrient levels significantly influenced number of tillers and plant height of oat. Though the highest number of tillers was registered when both the companion crops were grown at 100% NPK, it was statistically on a par with the number of tillers produced by oat in association with berseem at 75% NPK (Table 1). This might be owing to beneficial effect of legume on cereal (Singh and Arya, 1999). Highest plant height of oat was recorded under sole oat at 100% NPK which was statistically on a par with the sole oat at 75% NPK and oat+berseem at 100% NPK. These 3 treatments were significantly superior to rest of the treatments in respect of yield-attributing characters.

Herbage productivity

Though the highest green-herbage and dry-matter yields were obtained from the association of oat+berseem at 100% NPK, however, it was statistically on a par with the yield received in oat (75% NPK)+berseem (100% NPK) association (Table 1). This association also gave 41.2% more green-herbage yield than sole oat and 58.6% more than sole berseem grown at 100% NPK. This might be owing to synergistic effect of berseem on oat-yield attributes. Mishra *et al.* (1977) also recorded beneficial effect of legume forage compared to sole cereal.

The herbage yield was low because sowing was delayed by about a month. Secondaly, in later stage of growth during second fortnight of March proper irrigation

Table 1. Herbage yield and yield-attributing characters of oat+berseem intercropping as influenced by nutrient levels (pooled data of 2 years)

Treatment	Tillers/m row length in oat	Plant height of oat at harvest (cm)	Green-herbage yield (q/ha)	Dry-matter yield (q/ha)
Oat (100% NPK)	124.0	134.1	274	70.5
Oat (75% NPK)	113.9	131.5	244	63.4
Oat (50% NPK)	105.4	121.7	211	60.9
Oat (25% NPK)	89.4	103.1	169	49.8
Oat (control)	60.1	68.3	96	25.9
Berseem (100% NPK)			244	42.2
Oat+berseem (1:1) (75% +100% NPK)	134.0	126.7	387	90.3
Oat+berseem (1:1) (50%+100% NPK)	117.0	123.9	323	79.4
Oat+berseem (1:1) (25%+100% NPK)	107.0	113.4	296	74.1
Oat+berseem (1:1) (control+100% NPK)	105.0	105.3	240	60.5
Oat + berseem (1:1) (100%+100%NPK)	136.0	131.6	391	92.2
CD (P=0.05)	3.81	3.72	13.30	2.48

facility was not available due to unavoidable circumstances, resulting in, at least 1 cut in each component crop could not be taken which led to lower herbage yields.

Economic feasibility and yields

Oat grown at 75% NPK and berseem at 100% NPK accounted for the highest net return as well as return/rupee investment which was even higher than both oat+berseem produced at 100% NPK (Table 2). This clearly indicated that 25% saving in NPK nutrient can be made possible in 1:1 association of these 2 component species (Table 2).

Mishra *et al.* (1977) and Choubey *et al.* (2000) also reported such benefit from *kharif* cereal and legume association. It further revealed that this association of oat at 75% NPK +berseem at 100% NPK as well as both at 100% NPK computed for just equal value of LER (1.69). These 2 treatments further accounted for almost equal monetary advantage of Rs 12,639 and Rs 12,755/ha respectively.

Thus, based on biological and economic potentiality of these 2 forages, 1:1 ratio of oat at 75% NPK+berseem at 100% NPK may be a more sustainable association owing to its better performance than these 2 species which grown at 100% recom-

Table 2. Economics and yield advantage of oat + berseem intercropping as influenced by nutrient levels (pooled data of 2 years)

Treatment	Net returns (Rs/ha)	Return/ rupee investment (Rs/Re)	Per day return (Rs/ha/day)	Production efficiency (kg/day/ha)	Land-equivalent ratio	Monetary advantage (Rs/ha)
Oat (100% NPK)	4,957	1.57	104.50	26.96	1.00	
Oat (75% NPK)	3,901	1.47	91.70	24.46	1.00	
Oat (50% NPK)	2,661	1.34	81.50	21.47	1.00	
Oat (25% NPK)	951	1.13	64.10	17.26	1.00	
Oat (No NPK control)	–2,310	0.67	35.10	10.46	1.00	
Berseem (100% NPK)	16,702	3.16	187.40	19.42		
Oat+berseem (1:1) (75%+100% NPK)	21,242	3.19	237.70	29.50	1.69	12,639
Oat+berseem (1:1) (50%+100% NPK)	16,280	2.71	197.90	25.34	1.43	5,456
Oat+berseem (1:1) (25%+100% NPK)	14,286	2.53	182.30	23.58	1.36	6,243
Oat+berseem (1:1) (control+100% NPK)	10,053	2.10	147.70	19.16	1.15	2,510
Oat+berseem(1:1) (100%+100% NPK)	20,398	2.87	242.20	30.03	1.69	12,755
CD (P=0.05)	6,354	0.025	18.08	1.10	NS	8,910

mended level of NPK. This indicates a net saving in 25% NPK without reduction in forage yields and monetary gain.

REFERENCES

Choubey, S. and Bhagat, R.K. 1998. Forage productivity in teosinte + ricebean intercropping system. *Journal of Research, Birsa Agricultural University, Ranchi* **10** (2) : 167–171.

Choubey, S., Bhagat, R.K., Prasad, N.K. and Srivastava, V.C. 2000. Economic viability and energetics of teosinte (*Euchlaena maxicana)* : ricebean (*Vigna umbellata)* associations under different fertility levels. *Indian Journal of Agricultural Sciences* **70** (1) : 28–30.

Mishra, R.K., Choudhary, S.K. and Tripathi, A.K. 1997. Intercropping of cowpea (*Vigna unguiculata)* and horsegram (*Macrotyloma uniflorum)* with sorghum for fodder under rainfed condition. *Indian Journal of Agronomy* **42**(3) : 405–408.

Singh, R.V. and Arya, M.P.S. 1999. Nitrogen requirement of finger millet (*Eleusine coracana)* + pulse intercropping system. *Indian Journal of Agronomy* **44** (1) : 47–50.

Willey, R.W. 1979. Intercropping : its importance and research needs. Part I. Competition and yield advantages. *Field Crop Abstracts* **32** : 1–13.