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Effect of intercropping on high yielding fodder production in bathan areas of Sirajgonj district

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Abstract

The experiment was conducted at Bajar Para bathan of Shajadpur upazila under Sirajgonj district to study the effects of intercropping on high yielding fodder production in Bathan areas of Sirajgonj district. In this experiment, fodders were cultivated in 27 experimental plots of each size (15×15m) were arranged in 9 treatments as Khesari (Sole), Napier dwarf early, Napier dwarf late, Splendida, Jumboo, Khesari+Napier dwarf early, Khesari+Napier dwarf late, Khesari+Splendida and Khesari+Jumboo. The biomass yield of Napier dwarf early, Napier dwarf late, Splendida and Jumboo as sole crop were 100.32, 90.26, 72.31 and 48.33 ton/ha., respectively. The yield of Khesari was 58.76 ton/ha. as sole crop and differs significantly ($p<0.01$) when intercropped with Napier dwarf early, Napier dwarf late, Splendida and Jumbo. The fresh total biomass yield of intercropped high yielding fodders and Khesari was considerably higher (151.11 ton/h) compared to sole high yielding fodders (100.32 ton/h) and sole Khesari (58.76t/h). The total highest biomass yield (151.11 ton/ha.) was obtained from the combination of Napier dwarf early and Khesari intercropping, followed by Napier dwarf late and Khesari (134.63ton/ha.), Splendida and Khesari (115.73 ton/ha.) then Jumboo and Khesari (87.55 ton/ha.), respectively. The total biomass yield difference among the intercropped group was significant ($p<0.05$). The land equivalent ratio (LER) increased in the intercropped practices of Khesari+Napier dwarf early, Khesari+Napier dwarf late, Khesari+Splendida and Khesari+ Jumboo (1.84, 1.75, 1.73 and 1.65, respectively) compared with sole Napier dwarf early, Napier dwarf late, Splendida, Jumboo and Khesari. Benefit cost ratio (BCR) of Khesari+Napier dwarf early cropping method was 1.73 which was higher than others cropping method. It may be suggested to cultivate Napier dwarf early along with Khesari in the bathan land in the existing feeding system.

Key words: Bathan, benefit cost ratio, land equivalent ratio, Napier dwarf

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Introduction

The farmers of milk pocket areas practice free range feeding of their cattle in the Bathan. They cultivate Khesari and Jambo grasses were cultivated with natural grass. In the Bathan animal were supplied with green grass and rice straw. Milking cows were supplemented with concentrate feed in addition to roughage. The green grass/cultivated fodder only meet a portion of (2/3 of) the requirements. Napier grass (*Pennisetum purpureum* L) is a perennial forage crop with high growth rate, high productivity and good nutritive value (Wijitphan et al. 2009). Napier dwarf varieties have recently been grown and examined for their growth characteristics in tropical and sub-tropical regions in the world (Hanana et al. 1993). Napier dwarf grass facilitates hand-harvesting by farmers and is associated to be more suitable than normal variety (Williams and Hana 1995). Jumbo grass (*Sorghum bicolour Sorghum sudanefe*) is one of the promising grasses because of its rapid growth and high yield (Stuart 1990). It is popular because of its high productivity and ultra-late flowering nature triggered by short day length. It is also important because of its availability during summer fodder scarcity periods.

Splendida (*Setaria sphacelta var. splendid*) is highly palatable to all classes of livestock and is mainly used as forage. It may be grazed or used in a cut-and-carry system.

Legume intercrops are included in cropping systems due to their ability to reduce soil erosion, suppress weeds and fix biological N (Giller et al.

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1994), add soil organic matter (Hartwig and Hoffman 1975), reduce pests and diseases (Trenbath 1993), spread labour needs (van der Pol 1992) and can maintain productivity on the land for many years. Efficiency of land use is enhanced through more complete utilization of solar radiation (Keating and Carberry 1993), water (Morris and Garrity 1993a) and nutrients (Morris and Garrity 1993b). The most common companion crops for intercropping with cereals are groundnut (*Arachis hypogaea*), cowpea (*Vigna Unguiculata* L. Walp), grass pea (Lathyrus sativus), soybean (*Glycine max* [L] Merr), common bean (*Phaseolus Vulgaris*) and perennial legumes such as pigeonpea (*Cajanus cajan* (L) Millsp.) (MacColl 1989; Mafongoya 2006). These legumes are important because of N2-fixation reducing the reliance of external N sources of fertiliser (Giller et al. 1994). Kheshari Grass (Lathyrus sativus) is a promising crop for adaptation under climate change because of its tolerance to drought, water-logging and salinity, and being almost free from insect-pests and diseases. To introduce high yielding fodder (HYF) in Bathan areas, Bangladesh Livestock Research Institute (BLRI) set an experiment in the Bathan to study the effect of intercropping on high yielding fodder production of Napier dwarf early, Napier dwarf late and Splendida, Jumboo and Khesari with the aim of suggesting a suitable fodder varieties for that area

Materials and Methods

Fodder was cultivated in twenty seven plots (15m X 15m) which were arranged in 9 treatments (Khesari (Sole), Napier dwarf early, Napier dwarf late, Splendida, Jumboo, Khesari+Napier dwarf early, Khesari+Napier dwarf late, Khesari+ Splendida and Khesari+Jumboo) with 3 replications having homogenous soil characteristics. The basal dose of 70 kg triple super phosphate (TSP), 30 kg muriate of potash (MP), 25 ton farm yard manure (FYM) were applied during land preparation and 50 kg urea per hactre were applied after 6 weeks of sowing. The high yielding fodders were propagated by stem cutting method and khesari seeds were broadcasted in between the rows. Line to line and plant to plant distance were 70 and 35 cm, respectively. Fodder was harvested at a regular interval at 30 days after each cutting, while first cut was made 55 days after sowing. The similar interval of each grasses were 4 cutting number (harvests) from the time of starting of the experiment. The Khesari was harvested after 60 days of sowing.

Land equivalent ratio (LER) was determined the following formula (De Wit and Van Den Bergh, 1965 and Willey, 1979). The LER is computed by dividing the intercropped crop yields (ton/ha.) by the pure stand crop yields for each component crop in the intercrop, these two figures are then added together.

$$\text{LER} = \frac{\text{Intercropped yield of crop A}}{\text{Sole crop yield of crop A}} + \frac{\text{Intercropped yield of crop B}}{\text{Sole crop yield of crop B}}$$

where, LER = Land equivalent ratio; crop A = inter-cropped Khesari; crop B = inter-cropped Napier dwarf early

The statistical analysis was done using 'SPSS 11.5' statistical program to compute analysis of variance for randomized block design. Differences among the treatment means were determined by Duncan's Multiple range Test (Duncan 1955).

Results and discussion

The fresh yield of high yielding fodders intercropped with Khesari is presented in Table 1. It was observed that the biomass yield of Napier dwarf early, Napier dwarf late, Splendida and Jumboo as sole crop were 100.32, 90.26, 72.31 and 48.33 ton/ha., respectively. The yield of Khesari (control) was 58.76 ton/ha. as sole crop and differs significantly ($p<0.01$) when intercropped with Napier dwarf early, Napier dwarf late, Splendida and Jumbo. The results also revealed that the fresh total biomass yield of intercropped high yielding fodders and Khesari was considerably higher compared to sole high yielding fodders and sole Khesari.

Table 1. Fresh biomass yield per season (4 cutting) (ton/ha.) (Mean±SE) of high yielding fodder and Khesari with and without intercropping

Cropping method	Khesari	Napier dwarf early	Napier dwarf late	Splendida	Jumboo	Total	LER
Khesari (Sole)	58.76^{a}±3.9	-	-	-	-	58.76±3.92	1
Napier dwarf early (sole)	-	100.32^{a}±8.96	-	-	-	100.32±8.96	1
Napier dwarf late (sole)	-	-	90.26^{a}±9.38	-	-	90.26±9.38	1
Splendida (sole)	-	-	-	72.31^{a}±6.13	-	72.31±6.13	1
Jumboo (sole)	-	-	-	-	48.33^{a}±1.69	48.33±1.69	1
Khesari+Napier dwarf early	47.66^{b}±1.7	103.44^{a}±10.33	-	-	-	151.11^{a}±13.21	1.84
Khesari+Napier dwarf late	46.33^{b}±1.45	-	88.11^{a}±8.21			134.63^{b}±11.21	1.75
Khesari+ Splendida	45.45^{b}±1.69	-	-	70.22^{a}±5.89	-	115.73^{c}±10.21	1.73
Khesari+ Jumboo	40.33^{b}±1.21	-	-	-	47.22^{a}±2.10	87.55^{d}±7.56	1.65

Means with different superscripts in a column differed significantly (p<0.05); LER, Land Equivalent Ratio

In the variance analysis interaction values showed that the total highest biomass yield (151.11 ton/ha.) was obtained from the combination of Napier dwarf early and Khesari intercropping, followed by Napier dwarf late and Khesari (134.63 ton/ha.), Splendida and Khesari (115.73 ton/ha.) then Jumboo and Khesari (87.55 ton/ha.), respectively. The total biomass yield difference among the intercropped group was significant (p<0.05). Mureithi et al. (1995) showed a beneficial effect to Napier grass when grown together with leucaena in coastal lowland of Kenya. They recorded increased yield of Napier grass when planted adjacent to leucaena hedgerows than sole Napier grass or Napier grass growing away from leucaena.

Mwangi and Thorpe (2002) found out that intercropping Desmodium depressed DM yield of Napier grass but overall total yield (grass+ legumes) was higher. Increased yield of fodder grasses in intercrops compared to sole grass during the production phase could have been due to improved soil fertility through nitrogen fixation by the legumes. Legumes benefit the grass by contributing nitrogen to the soil through atmospheric N_2 fixation, decay of dead root nodules and mineralization of shed leaves. Seresinhe et al. (1994) has indicated that inclusion of legume in a pasture mixture stimulates the growth and increases the N uptake of grass. Results show intercropping legumes with Napier grass produced higher total yield advantage than sole grass. These results are in agreement with those of Akinyemi and Onayinka (1982) while working on Panicum and *Centrosema pubescence* sward mixture in Nigeria.

The land equivalent ratio (LER) was lower (1) in the sole Napier dwarf early, Napier dwarf late, Splendida, Jumboo and Khesari but increased in the intercropped practices of Khesari+Napier dwarf early, Khesari+Napier dwarf late, Khesari+ Splendida and Khesari+Jumboo were 1.84, 1.75, 1.73 and 1.65, respectively. Values of LER greater than 1 show an advantage while those less than 1 show a disadvantage of intercropping (De Wit and Van Den Bergh 1965). Results show intercropping Khesari with Napier grass increased LER than sole grass. Similar results were observed by Mac coll (1989) and Thakur and Sharma (1988).

Benefit cost ratio (BCR) of different inter cropping method is presented in the Table 2. It was observed that the yield of sole crop was far below than that of inter-cropped fodder. Therefore, all the treatments were not mentioned in Table 2. Total operating cost of intercropped of Khesari+Napier dwarf early, Khesari+Napier dwarf late, Khesari+Splendida and Khesari+ Jumboo were 113805, 113805, 114805 and 110205 Tk./ha., respectively.

Table 2. Benefit cost ratio (BCR) of different inter cropping method

Cropping method	Cost of cultivation (Tk./ha.)			
	Khesari+Napier dwarf early	Khesari+Napier dwarf late	Khesari+ Splendida	Khesari+ Jumboo
Ploughing	2470.00	2470.00	2470	2470
Fertilizer and manure	28360.00	28360.00	28360.00	28360.00
Seed/cutting	6150.00	6150.00	7150.00	13650.00
Irrigation	43225.00	43225.00	43225.00	43225.00
Labors	33600.00	33600.00	33600.00	22500.00
Total expenditure	113805.00	113805.00	114805.00	110205.00
Fodder sale price (Tk./ha.)	197000.00	180000.00	160000.00	127000.00
Net profit (Tk./ha.)	83195.00	66195.00	45195.00	16795.00
BCR	1.73	1.58	1.39	1.15

However, total sale price of Khesari+ Napier dwarf early, Khesari+Napier dwarf late, Khesari+Splendida and Khesari+Jumboo were 197000, 180000, 160000 and 127000 Tk./ha., respectively. Net profit of Khesari+Napier dwarf early intercropped method was 83195 Tk./ha. Huque and Islam (2006) found that net return from Napier production in Baghabari, Sirajgonj district was (26552 Tk./ha.). This value is lower than Khesari+Napier dwarf early intercropped value. The highest BCR was found in Khesari+Napier dwarf early (1.73) followed by Khesari+Napier dwarf late (1.58), Khesari+ Splendida (1.39) and Khesari+Jumboo (1.15).

Conclusion

The results from the current study showed that intercropping of Khesari with Napier dwarf early was a useful practice towards increasing profitability of the bathan land in the existing feeding system.

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