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Effect of intercropping of pearl millet and cluster bean on forage quality and quantity

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Abstract
A field experiment was performed at farmer's field. The objective of the study was to evaluate forage yield and quality of pearl millet intercropped with cluster bean. Experiment consisted of randomized complete block design with three replications. Cluster bean was planted in between the rows of pearl millet. Results showed that maximum leaf area per plant was observed for pearl millet sown in 30 cm apart rows. Minimum leaf area per plant, dry matter and fresh weight was observed for pear millet in drill sown of pearl millet in 30 cm apart rows and cluster bean in between the pearl millet. Maximum crude protein and crude fiber was observed for pearl millet and cluster bean in cluster bean sown alone by broadcast method. Maximum ash contents were observed for pearl millet and cluster beans sowing of pearl millet in drill sown of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows. So the pearl millet planted 30 cm apart and intercropped with cluster bean produced maximum yield and quality of forage than sole crop.

Keywords: Forage yield, Forage quality, Cluster bean, Pearl millet, Drill sowing, Intercropping, Dry matter.

Introduction
Millet is third most important cereal feed of Pakistan after wheat and rice, by providing a major portion of poultry and cattle feed Chughtai *et al.* [1]. Millet is grown as fodder and food in semi-arid and arid tropical environments in many countries of the world so millet is a necessary source of fodder Bhatnagar *et al.* [2]. The average area under pearl millet was about 475 thousand hectares and production 301 thousand tons Govt. of Pakistan [3]. Pearl millet are usually grown for grain in areas where ecological environment mainly temperature, rainfall and soil fertility are too severe to grow maize Hanna and Cardona [4].

Eskandari [5] performed an experiment to investigate effect of intercropping on forage yield and quality. Results showed that intercropping significantly affected forage yield, crude protein, acid detergent fiber and neutral detergent fiber. Furthermore intercropping increase crude protein yield and dry matter yield of maize. They concluded that for all the treatments land equivalent ratio was more than 1 which indicated that intercropping of maize with forage cowpea had more advantage.

Yield production through intercropping is higher than single cropping because in intercropping light, water and nutrients uptake more efficiently than sole cropping pattern Lithourgidis *et al.* [6]. Mostly research on intercropping was carried on legumes with cereals Ghosh *et al.* [7]. For increasing the crop production mix cropping is the simplest and cheap technology Awal *et al.* [8]. Renzende and Ramatto [9] reported that maize legume mix forage caused significant increase in protein concentration. Anil *et al.* [10] reported higher ash concentration in fodder when maize intercropped with runner bean. According to Zougmore *et al.* [11] when sorghum was intercropped with cow pea it reduced the run off losses up to 20-30% in comparison to alone sown sorghum, and doubled the green yield of intercropped plots. Gill and Verma [12] suggested that intercropping increased the nutrient quality of the forage, where perpendicular rows gave the best results. Sorghum sown in intercropping with cowpea was superior to bajra and guara.

Mobasser *et al.* [13] studied intercropping of cereals and legumes for forage yield and quality. They reported that intercropping produced more yield and better quality forage than grown separately.

Dahmardeh [14] studied intercropping of maize with peanut for yield of biomass and quality.

Results showed that intercropping at varying ratio produced higher yield and quality. They concluded that intercropping produced better results than sole crops of both maize and peanut. Khan *et al*. [15] reported that 24-55% yield benefits from planting patterns and intercropping. Guara planted in 45 cm spaced double row strip with mungbean gave the highest yields.

Material and Methods

Studies pertaining to different planting arrangements to check fodder yield and quality of pearl millet and cluster bean were carried out at farmer field. Experiment was laid out in randomized complete block design (RCBD) with three replications using the net plot size 2.1 m × 6 m. Treatment comprised of different seed proportions of pearl millet intercropped with cluster bean.

Treatments

$T_{1:}$ Pearl millet sown alone by broadcast method
$T_{2:}$ Cluster bean sown alone by broadcast method
$T_{3:}$ Pearl millet sown in 30 cm apart rows
$T_{4:}$ Cluster bean sown in 30 cm apart rows
$T_{5:}$ Broadcast of blended seed (pearl millet + cluster bean)
$T_{6:}$ Drill sowing of blended seed in 30 cm apart rows (pearl millet + cluster bean).
$T_{7:}$ Drill sowing of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows
$T_{8:}$ Drill sowing of pearl millet in 30 cm apart rows and cluster bean across wise

Results and Discussion

Analysis of the variance and mean comparisons of pearl millet and cluster bean for fresh weight showed there were highly significant differences observed for fresh weight. So, this trait can be incorporated in research program in this aspect. Fresh weight of pearl millet and cluster bean ranged from 40.00 to 86.67 tons ha^{-1}. Maximum fresh weight was observed for pearl millet and cluster beans in drill sown of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows. Minimum fresh weight was observed for pearl millet and cluster bean in cluster bean sown alone by broadcast method. This is concluded that pear millet sown in drill sown of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows had positive impact on fresh weight. The results are in agreement with Abbas [16], who reported maximum fresh weight by intercropping.

The analysis of the variance and mean comparisons for number of leaf area per plant of pearl millet showed significant difference. The pearl millet showed sufficient range of variations for leaf area per plant. Leaf area per plant of pearl millet ranged from 1936.7 to 2481.3cm^2. Maximum number of leaf area per plant was observed for pearl millet pearl millet in sown in 30 cm apart rows. Minimum leaf area per plant was observed for pear millet in drill sown of pearl millet in 30 cm apart rows and cluster bean across wise. The results are in agreement with Rao and Mathuva [17], Rana *et al.* [18], Hussain [19], Tawfiq and Ahmad [20], who reported increase in leaf area due to intercropping. The mean performance of pearl millet for leaf area per plant was differed non-significantly.

Analysis of the variance and mean comparisons of pearl millet and cluster bean for dry weight showed there were highly significant differences observed for Dry weight in the analysis of variance for all treatment. Dry weight of pearl millet ranged from 9.72 to 20.95%. Maximum dry weight was observed for pearl millet and cluster bean in drill sown of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows. Minimum dry weight was observed for pearl millet and cluster bean in cluster bean sown alone by broadcast method. This is concluded that pearl millet and cluster bean drill sown of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows. The mean performance of pearl millet and cluster bean for dry weight differed non-significantly.

Analysis of the variance and mean comparisons of pearl millet and cluster bean for crude protein are highly significant. Crude protein of pearl millet and cluster bean ranged from 10.65 to 19.35%. Maximum crude protein was observed for pearl millet and cluster bean in cluster bean sown alone by broadcast method. Minimum crude protein was observed for pearl millet and cluster bean in drill sown of pearl millet in pearl millet sown alone by broadcast method. The results are in agreement with Ayub *et al.* [21] who reported increased protein percentage in intercropping. The mean performance of pearl millet and cluster bean for crude protein differed non-significantly.

Analysis of the variance and mean comparisons of pearl millet and cluster bean for crude fiber are highly significant. The pearl millet and cluster bean showed sufficient range of variations for crude fiber. Crude fiber of pearl millet and cluster bean ranged from 13.31 to 33.10%. Maximum crude fiber was observed for pearl millet and cluster bean in pearl millet sown alone by broadcast method. Minimum crude fiber was observed for pearl millet and cluster bean in cluster bean in sown in 30 cm apart rows. This is concluded that pearl millet and cluster bean in pearl millet sown alone by broadcast method had positive effect on crude fiber of pearl millet and cluster bean. The results are in agreement with Ibrahim *et al*. [22], Abbas [23], Hussain [19] and Akhtar [24], who reported significant, increased in crude fiber value in intercropping. The mean performance of pearl millet and cluster bean for crude fiber differed non-significantly.

Analysis of the variance and mean comparisons of pearl millet and cluster bean for ash contents are highly significant. The pearl millet and cluster bean showed sufficient range of variations for ash contents. So, this trait can be incorporated in research program in this aspect. Ash contents of pearl millet and cluster bean ranged from 7.71 to 16.24%. Maximum ash contents were observed for pearl millet and cluster beans sowing of pearl millet in drill sown of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows. Minimum ash contents were observed for pearl millet and cluster bean in cluster bean in sown in 30 cm apart rows. This is concluded that pearl millet and cluster bean in drill sown of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows. The results are in agreement with Ibrahim *et al*. [22], Abbas [23], Hussain [19] and Akhtar [24], who reported significant increase in ash contents value in intercropping. The mean performance of pearl millet and cluster bean for ash contents differed non-significantly.

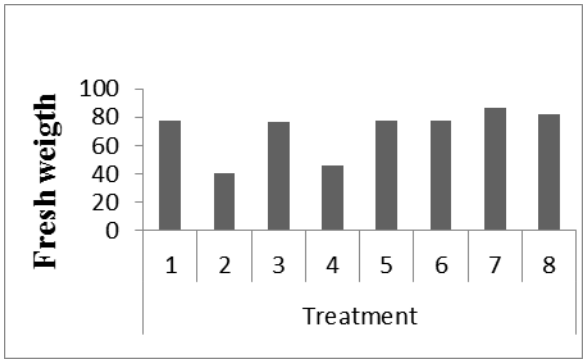

Fig 1: Mean comparisons of fresh weight

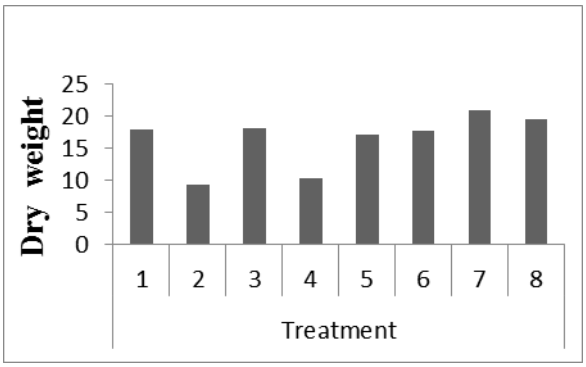

Fig 2: Mean comparisons of dry weight

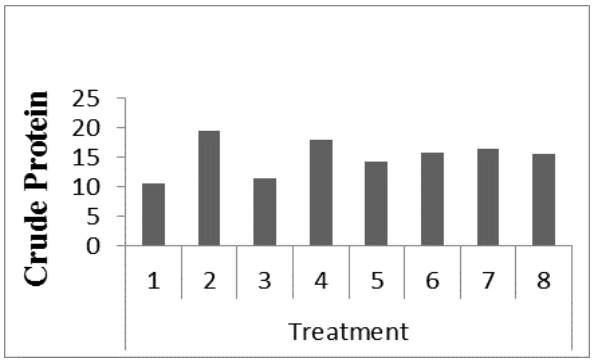

Fig 3: Mean comparisons of crude protein

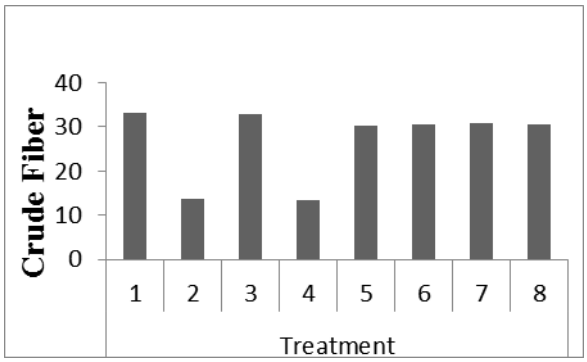

Fig 4: Mean comparisons of crude fiber

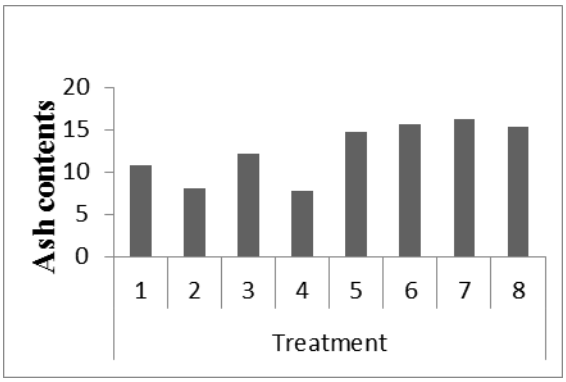

Fig 5: Mean comparisons of ash content

Conclusion

Minimum leaf area per plant, dry matter and fresh weight was observed for pearl millet in drill sown of pearl millet in 30 cm apart rows and cluster bean in between the pearl millet. Maximum crude protein and crude fiber was observed for pearl millet and cluster bean in cluster bean sown alone by broadcast method. Maximum ash contents were observed for pearl millet and cluster beans sowing of pearl millet in drill sown of pearl millet in 30 cm apart rows and cluster bean in between pearl millet rows. Pearl millet intercropped with cluster bean produced higher yield and quality of forage. So for maximum utilization of land area and resources and to obtain best quality fodder intercropping produced best result for forage yield and quality. Intercropping reduce cost to benefit ratio and increase economic benefits for farmers.

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