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PRODUCTIVITY AND QUALITY OF FORAGE MAIZE UNDER DIFFERENT LEGUME INTERCROPPING SYSTEMS

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ABSTRACT

A field experiment was conducted during *kharif*, 2019 on sandy loam soils of Wetland farm of S.V. Agricultural College, Tirupati campus of Acharya N.G. Ranga Agricultural University. The results of the experiment revealed that intercropping system of maize + cowpea in 3:1 ratio recorded significantly higher total green fodder and dry fodder yield. Quality parameters like crude protein and crude fibre yield were also high in maize + cowpea intercropping system in 3:1 ratio, followed by maize + cowpea in 2:1 ratio.

KEY WORDS: Forage maize, intercropping system, cowpea, fodder yield

INTRODUCTION

India is the largest country which is having 536 million livestock population. Fodder production is a foremost determining factor for a flourishing livestock enterprise in India. Agricultural land is declining day by day owing to non agricultural purposes. It is generally quite impossible to set aside cultivable land exclusively for fodder cultivation, as it is not sufficient for food crop production. Currently, total area under fodder crops is 8.6 m ha which accounts for less than 4.5 per cent of area under cultivation and is inadequate to meet the fodder requirement of actually existing livestock. It is rather necessary to incorporate fodder production in existing cropping systems. Also, majority of the fodder crops cultivated on marginal lands along with monocultures are deficient in qualitative and nutritive traits. Fodder rich in these traits can only solve problem of malnutrition in animals.

The primary objective of forage maize production is to supply nutritive fodder in correspondence with feed requirement of cattle. Even though maize gives high yield in terms of dry matter yield, it produces fodder with less protein content. Therefore, it is necessary to enhance forage quality by mixing suitable fodder legumes without reduction in forage yield. The low protein concentration in forage maize can be augmented by inclusion of forage legumes as they are rich in proteins. High quality of forage has been informed as a vital feature of forage crop production. Legumes have high quality forage, but low dry matter content. Therefore, cereal legume combination is deliberated as a management strategy in generating both high quality and quantity of forage.At present, maize-legume intercropping system is given global attention due to its leading importance in world agriculture. The fodder yield and protein yield of forage were enhanced by all intercropping compositions as compared to the maize monocultures (Javanmard *et al.,* 2009). Accordingly, this study was carried out to assess the green fodder yield and quality in terms of fodder yield and protein yield using different intercropping systems.

MATERIAL AND METHODS

The field experiment was conducted during *kharif,* 2019 at Wetland farm of S.V. Agricultural College, Tirupati campus of Acharya N.G. Ranga Agricultural University, Andhra Pradesh. The soil of experimental site was sandy clay loam having 0.25% organic carbon, 160 kg ha^{-1}, 15.25 kg ha^{-1} and 265 kg ha^{-1} of available N, P_2O_5 and K_2O respectively. A total rainfall received during the crop period was 460.4mm in 24 rainy days. The experiment was laid out in a randomized block design with ten treatments comprised of sole maize (T_1), maize + cowpea (1:1) (T_2), maize + pillipesara (1:1) (T_3), maize + ricebean (1:1) (T_4), maize + cowpea (2:1) (T_5), maize + pillipesara (2:1) (T_6), maize + ricebean (2:1) (T_7), maize + cowpea (3:1) (T_8), maize + pillipesara (3:1) (T_9) and maize + ricebean (3:1) (T_{10}) (Table 1). Forage maize as

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Table 1. Green and dry fodder yields of forage maize and legumes as influenced by intercropping systems

Treatments	Green fodder yield (t ha^{-1})			Dry fodder yield (t ha^{-1})		
	Forage maize	Intercrop	Total green fodder yield	Forage maize	Intercrop	Total dry fodder yield
T_1 : Sole Maize	47.8	-	47.8	11.1	-	11.1
T_2 : Maize + cowpea (1:1)	22.6	23.8	46.4	5.6	4.7	10.3
T_3 : Maize + pillipesara (1:1)	28.1	4.9	33.0	6.8	0.9	7.7
T_4 : Maize + ricebean (1:1)	27.2	17.0	44.2	6.7	3.2	9.9
T_5 : Maize + cowpea (2:1)	33.1	21.1	54.2	8.2	3.9	12.1
T_6 : Maize + pillipesara (2:1)	35.1	3.1	38.2	8.5	0.5	9.0
T_7 : Maize + ricebean(2:1)	34.2	14.2	48.4	8.4	2.8	11.2
T_8 : Maize + cowpea (3:1)	40.1	20.8	60.9	10.0	3.7	13.7
T_9 : Maize + pillipesara (3:1)	42.8	2.9	45.7	10.4	0.5	10.9
T_{10} : Maize + ricebean (3:1)	41.8	11.1	52.9	10.1	2.0	12.1
SEm±	1.12	0.57	1.76	0.28	0.12	0.33
CD (P = 0.05)	3.3	1.7	5.2	0.8	0.3	0.9

Table 2. Crude protein yield and crude fibre yield of forage maize and legumes as influenced by intercropping systems

Treatments	Crude protein yield (t ha^{-1})			Crude fibre yield (t ha^{-1})		
	Forage maize	Intercrop	Total crude protein yield	Forage maize	Intercrop	Total crude fibre yield
T_1 : Sole Maize	1.00	-	1.00	3.38	-	3.38
T_2 : Maize + cowpea (1:1)	0.48	0.88	1.36	1.48	0.97	2.45
T_3 : Maize + pillipesara (1:1)	0.51	0.17	0.68	1.96	0.21	2.17
T_4 : Maize + ricebean (1:1)	0.50	0.63	1.13	1.95	0.68	2.63
T_5 : Maize + cowpea (2:1)	0.65	0.79	1.44	2.42	0.80	3.22
T_6 : Maize + pillipesara (2:1)	0.67	0.09	0.76	2.44	0.13	2.57
T_7 : Maize + ricebean (2:1)	0.66	0.52	1.18	2.43	0.60	3.03
T_8 : Maize + cowpea (3:1)	0.81	0.74	1.55	2.90	0.76	3.66
T_9 : Maize + pillipesara (3:1)	0.86	0.08	0.94	2.92	0.12	3.04
T_{10} : Maize + ricebean (3:1)	0.82	0.47	1.19	2.91	0.54	3.45
SEm±	0.043	0.022	0.041	0.152	0.035	0.061
CD (P=0.05)	0.13	0.06	0.10	0.45	0.07	0.18

well as intercrops were sown in lines, 30 cm apart by adopting all the standard package of practices.The recommended fertilizer dose of 120 kg N, 50 kg P_2O_5 and 40 kg K_2O ha^{-1} was applied only for forage maize.Half of the dose of N and whole amount of P and K was applied as basal and the remaining half dose of nitrogen was applied at 30 DAS. Maize and legume intercrops were harvested for green fodder purpose at 70 DAS. The treatment wise green fodder yield of maize and intercrops were harvested from each net plot. The quality parameters such as crude protein yield and crude fibre yield were estimated in the laboratory by using the standard procedures as recommended by A. O. A. C (1990).

RESULTS AND DISCUSSION

Green and dry fodder yields were significantly affected by different intercropping systems (Table 1). The total green and dry fodder yields were higher with maize + cowpea intercropping system in 3:1 ratio and significantly superior to the other intercropping systems and sole maize. Significantly lower total green and dry fodder yields were recorded with maize + pillipesara intercropping system in 1:1 ratio.

The higher total green forage yields in intercropping system of maize with cowpea in 3:1 ratio might be attributed to complementary effect of cowpea, which might have supplemented nitrogen to maize and the better utilization of solar radiation, space and nutrients from soil by maize + cowpea intercropping system. Furthermore, increase in total green forage yields in the intercropping systems might be owing to better utilization of space and light interception coupled with nutrient contribution of leguminous fodder to cereal. The increase in dry fodder yield was also due to increase in green forage yield in intercropping treatments. These results were in accordance with the findings of Sharma *et al*. (2008) and Asangla and Gohain (2016).

The influence of intercropping system of maize with cowpea in 3:1 ratio was clearly evident in total crude protein and crude fibre yield (Table 2). Significantly higher total crude protein and crude fibre yield of the system was recorded with maize+ cowpea (3:1) over the other intercropping systems.

The difference in quality parameters in all the intercropping systems were noticed mainly due to variation in dry fodder yields of maize, cowpea, pillipesara and ricebean, which was the reflection of contribution from both the component crops resulting in enhanced production of quality components through complementary relationship. Similar findings were also reported by Yilma (2002) and Chotiya (2005).

CONCLUSION

The study has revealed that intercropping of forage maize with cowpea in 3:1 row proportion, was proved to be suitable and economically sustainable for realizing higher productivity and quality during *kharif* season for Southern Agro-climatic Zone of Andhra Pradesh.

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