Evaluation of Fodder Crops for Scarce Rainfall Zone of Andhra Pradesh

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ABSTRACT: A Field experiment was conducted at Agricultural Research Station, Ananthapuramu in rainfed alfisols for three years (*kharif* 2021 to 2023) to evaluate the performance of different fodder crops. Eight treatments consisting of three perennial grasses, two annual and three legume fodder crops were tested in a randomized block design with three replications. Mean data of three years indicated that among the fodder crops, significantly higher total green fodder yield was recorded with fodder cowpea (18.79 t/ha) compared to other crops except rhodes grass (18.55 t/ha), fodder bajra (17.18 t/ha), fodder sorghum (15.50 t/ha) and hedge lucerne (13.97 t/ha). Sewan grass recorded significantly lower total green fodder yield of 5.43 t/ha. The highest net returns and B:C ratio was recorded with fodder cowpea followed by hedge lucerne and *Stylosanthes*. Among different crops, fodder cowpea, fodder bajra and rhodes grass were found suitable for scarce rainfall zone of Andhra Pradesh.

Keywords: Economics, fodder crops, green fodder yield

Introduction

In Andhra Pradesh, out of 40.0 lakh ha of rainfed area 45% (16.0 lakh ha) is in scarce rainfall zone of Andhra Pradesh consisting Ananthapuramu (546 mm annual rainfall) and Kurnool (630 mm) districts (Yellamanda Reddy *et al.,* 2020). About 25% of total rainfed area of Andhra Pradesh is in Ananthapuramu district which is the rain shadow area of Andhra Pradesh and lowest rainfall receiving area next to Jaisalmar in India. Ananthapuramu district leads in sheep and goat population followed by Prakasam, Kurnool, YSR Kadapa and Chittoor districts (ICAR-IGFRI, 2021). With the changing socio-climatic environment, farmers are shifting from traditional agriculture to livestock farming as the livestock farming provides more sustainable livelihood and supplementary income. Mechanization in agriculture in recent years has led to a 10 to 15% reduction in the availability of coarse cereal crops for livestock feeding (Mukesh Choudhary *et al.,* 2022). Unless measures to mitigate the fodder shortage are taken, the livestock production and dairying are going to be adversely affected. The animals require green, dry fodder and concentrate feed to yield more production. However, there is 41% shortage in green fodder, 42% shortage in feed concentrates and 20% shortage in dry fodder in the state. Most often, livestock is the only source of cash income for subsistence farms and also provides drought proofing by serving as insurance in the event of crop failure. Thus, livestock imparts risk bearing capability to the much vulnerable farming communities. Rapidly developing peri-urban livestock farming, emerging fodder markets, vibrant cooperative dairy sector and availability of livestock products in super markets are indicators of fast changing economic scenario in livestock sector (Ghosh *et al*., 2016). Due to continuous failure of the crop's farmers are shifting to the crop diversification and integrated farming systems approach. Groundnut is the major crop in the Ananthapuramu district which provides the sufficient fodder to the farm cattle. However, the farmers are gaining importance of the integrated farming systems approach and they are looking for the alternate dryland crops that fit into the system. There is wide array of forage crops grown in rainfed areas. Hence, an experiment was planned with an objective of selection of suitable fodder crop for year-round supply of fodder to live stock in rainfed *Alfisols.*

Materials and Methods

Field experiment was conducted at Agricultural Research Station, Ananthapuramu in rainfed Alfisols for three years during *kharif*, 2021 to 2023. Eight treatments consist of three perennial grasses, two annual and three legume forage crops were tested in randomized block design with three replications. The treatment details and package of practices followed are furnished in Table.1. The treatments are three perennial grasses Viz. Sewan grass (*Lasiuruss indicus), Anjan grass (Cenchurus setigerus), Rhodes grass (Chloris gayana), two annual forage crops* Multicut jowar (*Sorghum bicolor*), Fodder bajra (*Pennisetum glaucum*) and three legumes Hedge Lucerne (*Desmanthus virgatus*), Stylo *(Stylosanthus hamata)* and Fodder cowpea (*Vigna unguiculata*). All the crops were planted during *kharif* 2021 except sewan grass which was planted during *kharif* 2022. During first year of establishment (2021) only two cuts were done and during 2022 and 2023 three times cutting was done. The initial soil fertility was low in organic carbon (0.20%), low in available nitrogen, high in available phosphorous (110 kg/ha) and low in available potassium (95 kg/ha). An amount of 936, 759 and 443 mm rainfall was received in 44, 39, 27 rainy days during the crop season of 2021, 2022 and 2023 respectively. Two supplemental irrigations were given during *kharif* 2023 during dry spells. *Stylosanthes*, hedge lucerne, fodder cowpea, sorghum and bajra seeds were sown by line sowing. Sewan grass, Anjan grass and Rhodes grass rooted slips were planted.

The recommended dose of fertilizers for was applied through urea, single super phosphate and muriate of potash respectively. Plant height was recorded before the first cut. First cut of fodder crops was done 50 days after sowing, second cut was done 35 days after first cut and third cut was done 30 days after second cut. Data on green-forage yield per plot were recorded for each cut and total system yield was calculated. One third nitrogen, entire dose of phosphorous and potash was applied at the time sowing. Second dose of nitrogen was applied after the first cut and third dose of nitrogen was applied after the second cut.

Table 1: Treatment details and package of practices adopted for different fodder crops

Treatment	Class	Scientific name	Variety	Seed rate (kg/ha)	Spacing (cm)	Fertilizer dose (N-P_2O_5-K_2O) (kg/ha)
Stylo grass	Legume fodder	*Stylosanthes hamat*a	Phule Kranti	5	30 x 15	20-60-0
Sewan grass	Perennial grass	*Lasiurus sindicus*	CAZRI-30-5	25,000 rooted slips	45 x 30	45-30-30 and 25 kg/ha N after each cut
Hedge lucerne	Legume fodder	*Desmanthus virgatus*	CO-1	15	45 x 30	30-60-40 and 30 kg/ha N after each cut
Anjan grass	Perennial grass	*Cenchrus setigerus*	CAZRI-76	30,000 rooted slips	45 x 30	40-40-20 and 50 kg/ha N after each cut
Rhodes grass	Perennial grass	*Chloris gayana*	Katambora	1,50,000 rooted slips	45 x 30	45-30-30 and 30 kg/ha N after each cut
Fodder cowpea	Legume fodder	*Vigna unguiculata*	GFC-4	35	30 x 10	20-60-40
Fodder sorghum	Annual fodder	*Sorghum bicolor*	Co (FS)-29	25	30 x 10	60-40-30 and 30 kg/ha N after each cut
Fodder bajra	Annual fodder	*Pennisetum glaucum*	TSFB-5	10	30 x 10	40-30-20 and 25 kg/ha N after each cut

Results and Discussion

Green fodder yield

During *kharif* 2021, significantly higher green fodder yield of first cut was recorded with rhodes grass (9.65 t/ha), which was on par with fodder bajra (9.24 t/ha), hedge lucerne (9.16 t/ha) and fodder sorghum (8.94 t/ha). During second cut, significantly higher green fodder yield was recorded with fodder cowpea (4.366 t/ha) compared to fodder sorghum (3.02 t/ha) and fodder bajra (2.78 t/ha). However, significantly higher total green fodder yield was recorded with fodder bajra (12.03 t/ha), but was on par with fodder sorghum (11.96 t/ha), rhodes grass (11.92 t/ha) and hedge lucerne (11.53 t/ha) (Table 2). During *kharif* 2022, in first cut, significantly higher green fodder yield was recorded with fodder bajra (13.32 t/ha), which was on par with fodder sorghum (13.01 t/ha) and fodder cowpea (12.14 t/ha) (Table 2). During second cut, significantly higher green fodder yield was recorded with fodder cowpea (7.45 t/ha), which was on par with stylo grass (6.43 t/ha) and hedge lucerne and rhodes grass together with an yield of 6.37 t/ha. During the third cut, significantly higher green fodder yield was recorded with *stylo* grass (5.62 t/ha) compared to anjan grass (4.87 t/ha) and fodder bajra (4.39 t/ha). However, significantly higher total green fodder yield was recorded with fodder cowpea (22.43 t/ha), which was on par with fodder bajra (20.39 t/ha). Rhodes grass and *stylo* grass recorded total green fodder yield of 19.92 and 19.19 t/ha, respectively.

During *kharif* 2023, in first cut, significantly higher green fodder yield was recorded with fodder bajra (12.99 t/ha), which was on par with fodder sorghum (11.80 t/ha). Fodder cowpea recorded green fodder yield of 10.80 t/ha (Table 2). During second cut, significantly higher green fodder yield was recorded with anjan grass (7.54 t/ha), which was on par with rhodes grass (7.40 t/ha) and fodder cowpea (7.20 t/ha). During the third cut, significantly higher green fodder yield was recorded with hedge lucerne (7.25 t/ha) compared to fodder cowpea (5.85 t/ha) and Anjan grass (4.50 t/ha). However, significantly higher total green fodder yield was recorded with fodder cowpea (23.85 t/ha), which was on par with rhodes grass (23.80 t/ha). Fodder bajra and fodder sorghum recorded total green fodder yield of 19.11 and 16.97 t/ha, respectively.

Pooled analysis of three years data indicated that among the fodder crops tested, significantly higher fodder yield of first cut was recorded with fodder bajra (11.85 t/ha) but was on par with fodder sorghum (11.25 t/ha) and rhodes grass (10.39 t/ha). The higher fodder yield was might be due to more accumulation of nutrients during respective stages of crop growth. The beneficial effect of nitrogen with higher photosynthetic activity and protein synthesis may promote cell division and cell elongation which accelerate the vegetative growth (Srivani *et al.,* 2023). Among legume fodder crops, cowpea recorded green fodder yield of 9.55 t/ha (Table 2). During second cut, significantly higher green fodder yield was recorded with fodder cowpea (6.34 t/ha) but was on par with rhodes grass (5.34 t/ha), hedge lucerne (4.65 t/ha), anjan grass (4.40 t/ha) and stylosanthes (3.84 t/ha). During third cut, hedge lucerne recorded significantly higher yield of 5.69 t/ha but was on par with stylosanthes (5.01 t/ha), anjan

grass (4.68 t/ha), rhodes grass (4.20 t/ha), fodder cowpea (4.34 t/ha), sewan grass (2.26 t/ha) compared to fodder sorghum (1.85 t/ha). Fodder crops develop swiftly and cover the ground surface quickly, even in low-rainfall conditions, producing a significant amount of green fodder while also providing vegetative cover over the land, resulting in resource conserving as well as increased productivity (Kumari *et al.,* 2017).

Pooled analysis of three years data indicated that, significantly higher total green fodder yield was recorded with fodder cowpea (18.79 t/ha) but was on par with rhodes grass (18.55 t/ha), fodder bajra (17.17 t/ha), fodder sorghum (15.50 t/ha) and hedge lucerne (13.96 t/ha) (Table 2). In general, the fodder yields were more in second and third year compared to first year of establishment. Application of fertilisers and sufficient moisture lead to a greater number of tillers resulting in higher fodder yields during second and third cuts (Srivani *et al.,* 2023). Reddy *et al.,* (2022) reported that fodder bajra, fodder sorghum and fodder maize are the potential forage cereals as they could produce higher quantity and quality fodder. Fodder cowpea and sunhemp are the next best suitable forage legumes under late-sown conditions in rainfed alfisols of scarce rainfall zone of Andhra Pradesh.

Table 2: Green fodder yield (t/ha) of different fodder crops

Crop	First cut				Second cut				Third cut			Total			
	2021	2022	2023	Mean	2021	2022	2023	Mean	2022	2023	Mean	2021	2022	2023	Mean
Stylo grass	2.73	7.14	5.80	5.22	0.53	6.43	4.58	3.84	5.62	4.40	5.01	3.26	19.19	14.78	12.41
Sewan grass	--	1.44	1.35	1.39	--	1.94	1.60	1.77	1.63	2.90	2.26	--	5.02	5.85	5.43
Hedge lucerne	9.16	3.17	4.20	5.51	2.37	6.37	5.22	4.65	4.14	7.25	5.69	11.53	13.70	16.67	13.96
Anjan grass	3.61	3.57	4.25	3.81	1.10	4.55	7.54	4.40	4.87	4.50	4.68	4.71	13.00	16.29	11.33
Rhodes grass	9.65	10.34	11.20	10.39	2.26	6.37	7.40	5.34	3.21	5.20	4.20	11.92	19.92	23.80	18.55
Fodder cowpea	5.72	12.14	10.80	9.55	4.36	7.45	7.20	6.34	2.83	5.85	4.34	10.09	22.43	23.85	18.79
Fodder sorghum	8.94	13.01	11.80	11.25	3.02	2.75	3.25	3.01	1.78	1.92	1.85	11.96	17.56	16.97	15.50
Fodder bajra	9.24	13.32	12.99	11.85	2.78	2.67	3.21	2.89	4.39	2.91	3.65	12.03	20.39	19.11	17.17
S.Em.±	0.35	0.39	0.45	0.63	0.23	0.38	0.48	0.93	0.24	0.37	1.14	0.21	0.71	0.74	1.76
CD (P=0.05)	1.11	1.19	1.39	1.95	0.72	1.16	1.481	2.87	0.73	1.15	3.53	0.68	2.19	2.28	5.42

Economics

Mean data of cost of cultivation, gross returns, net returns and B;C ratio indicated that highest gross returns of ₹. 93,955/ha, net returns of ₹. 74,305/ha and B:C ratio of 4.78 was recorded with fodder cowpea followed by hedge lucerne and *Stylosanthes* (Table 3). Reddy *et al.,* (2022) reported that higher gross and net returns were realized with fodder bajra, which could be owing to its higher biomass potential and drought tolerance, making it a good cereal fodder crop under rainfed conditions.

Table 3: Economics of different fodder crops

Crop	Green fodder yield (t/ha)	Cost of cultivation (₹./ha)	Net returns (/₹.ha)	B:C ratio	RWUE (kg/ha-mm)
Stylo grass	12.41	20700	41365	2.99	17.41
Sewan grass	5.43	14500	1808	1.12	7.62
Hedge lucerne	13.96	20350	49495	3.43	19.59
Anjan grass	11.33	14500	19514	2.34	15.90
Rhodes grass	18.55	21500	34150	2.58	26.02
Fodder cowpea	18.79	19650	74305	4.78	26.35
Fodder sorghum	15.50	17350	29159	2.68	21.74
Fodder bajra	17.17	17500	34037	2.94	24.09

Stylosanthes, hedge lucerne and fodder cowpea: ₹.5.0 per kg; Sewan grass, Anjan grass, Rhodes grass, fodder sorghum and bajra: ₹.3.0 per kg

Rainwater use efficiency

Mean of three years indicated that, significantly higher rainwater use efficiency was recorded with fodder cowpea (26.35 kg/ha-mm) followed by rhodes grass (26.02 kg/ha-mm) and fodder bajra (24.09 kg/ha-mm), fodder sorghum (21.74 kg/ha-mm) and hedge lucerne (19.59 kg/ha-mm) (Table 3).

Conclusion

Based on a three year study, it may be concluded that fodder cowpea, rhodes grass, fodder bajra and fodder sorghum were suitable for the rainfed alfisols of scarce rainfall zone of Andhra Pradesh.

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