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Effect of planting methods and forage crop combinations on fodder productivity through moisture conservation

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Introduction

Out of 140.02 million ha cultivated area of the country, 76.76 million ha (54.82 %) is rainfed having soils with poor fertility and numerous physiochemical constraints. The productivity of animals is very low because of shortage of green fodder during most of the years. The poor feed quality and dry season feed shortage are the serious limitations for livestock production in rainfed areas & farmers maintain a large herd of animals to compensate for the low productivity of the livestock, which adds to the pressure on land and fodder resources (Pathak, 2005).

Western Maharashtra region suffers from very low rainfall with uncertainty and ill distribution. Occurrence of drought noticed once in three years. The water scarcity and delayed monsoon are major problems of crop production. The efforts needed to increase production through suitable agro forestry system fit to the land, climate and resources. Incorporation of trees and bushes particularly of fodder values in agricultural production system through a systematic manner will help in providing sufficient fodder to the farmers without affecting arable crop yields (Deb Roy, 1994).

Cenchrus ciliaris and Dichanthium anulatum are potential fast growing range grasses and having good regeneration capacity and can withstand moisture stress for fairly long time. *Desmanthus, Siratro* and *Stylosanthes* are legume fodder species which give nutritious fodder and could be grown under rainfed situations. Grasses and legume contributed to binding and soil stabilization due to their extensive root system. The overall impact of the soil conservation measures and pastoral systems resulted in increased infiltration rate, reduced soil loss and increased water stable aggregates. Therefore high productive, more palatable, perennial and persistent legumes like *Stylosanthes* and *Desmanthus* are thought to be the best suitable to overcome protein deficiency. Keeping the above points in view, the present study was undertaken to develop appropriate fodder production technology under rainfed conditions through moisture conservation.

Materials and Methods

A field experiment was conducted at Central Research Station of BAIF Development Research Foundation, Urulikanchan, Pune during 2009-12 to study the effect of planting methods and forage crop combinations on fodder productivity through moisture conservation. The experiment was conducted in light gravel soil having initial soil status of 0.35 dS m^{-1} EC, 7.36 pH, 0.30 % organic carbon, 128, 34 and 265 Kg ha^{-1} NPK respectively. There were four combinations of grasses with legume *viz*. *Cenchrus ciliaris + Desmanthus virgatus, Cenchrus ciliaris + Stylosanthes seabrana, Dichanthium annulatum + Desmanthus virgatus, Dichanthium annulatum + Stylosanthes seabrana* in 1:1 proportion planted with two moisture conservation techniques *viz*. ridges and furrows & flat bed. Therefore, eight treatment combinations replicated three times in a factorial randomized block design (FRBD).

The grasses were established by planting seedlings at a spacing of 90 cm X 45 cm & legumes sown in between the two rows of grass, *i.e*. 1:1 proportion of 45 cm spacing maintained in between two rows. Soil fertility status (pH, EC, OC, N, P and K), microbial population count was determined using the methods described in (AOAC, 1995) and soil moisture data were recorded. The grasses and legumes were cut at 45-50 days interval. The growth and yield parameters were recorded at every cut and samples were analyzed in laboratory by using standard analytical methods. The pooled four years data was statistically analyzed.

Results and Discussion

The pooled data on green fodder, dry matter and crude protein yields as influenced by different planting methods and forage crop combinations is given in Table 1.

Table 1: Effect of planting methods and forage crop combinations on green fodder, dry matter & crude protein yields

Treat. no.	Treatments details	Yield (ha^{-1})		
		Green fodder	Dry matter	Crude protein
T_1	Ridges and furrows, *Cenchrus ciliaris +Desmanthus virgatus*	763.11	165.54	18.92
T_2	Ridges and furrows, *Cenchrus ciliaris +Stylosanthes seabrana*	664.78	139.51	16.18
T_3	Ridges and furrows, *Dichanthium annulatum + Desmanthus virgatus*	456.83	101.54	11.82
T_4	Ridges and furrows, *Dichanthium annulatum + Stylosanthes seabrana*	423.19	92.86	11.05
T_5	Flat bed, *Cenchrus ciliaris +Desmanthus virgatus*	724.34	156.75	17.75
T_6	Flat bed, *Cenchrus ciliaris +Stylosanthes seabrana*	649.53	141.41	16.66
T_7	Flat bed, *Dichanthium annulatum + Desmanthus virgatus*	413.31	89.67	10.62
T_8	Flat bed, *Dichanthium annulatum + Stylosanthes seabrana*	360.60	82.24	10.01
	SE (m)±	5.66	1.14	0.16
	CD at 5%	15.68	3.16	0.44
	CV %	19.26	18.14	17.41

Based on the pooled data for four years (2009-12), it was revealed that significantly increase in the green fodder, dry matter and crude protein yields (763.11, 165.54 and 18.92 ha^{-1} per year respectively) in treatment combination of planting *Cenchrus ciliaris* with *Desmanthus virgatus* in 1:1 proportion on ridges and furrows over all the other planting methods & moisture conservation technique. Patel *et al.*, (2007) reported that Marvel grass may be fertilized with 60 kg ha^{-1} and harvested once at the time of maturity to obtain higher dry fodder yield. Treatment combination of planting *Cenchrus ciliaris* with *Desmanthus virgatus* in 1:1 proportion on ridges and furrows showed significantly higher net monetary return of Rs. 55529 ha^{-1} per year, benefit cost ratio of 2.72 and maize fodder equivalent yield of 308 qha^{-1}. The experiment conducted by Kumar and Faruqui (2009) recorded maximum dry matter yield of 4.55 tonnes ha^{-1} in Aonla + *Cenchrus ciliaris + Stylosanthes hamata* over the 3.92 tonnes ha^{-1} in pure *Cenchrus ciliaris + Stylosanthes hamata* pasture system when applied with highest doses of nitrogen (60 kg ha^{-1}). The pooled data on economics of the crops as influenced by different planting methods and forage crop combinations are given in Table 2.

Table 2: Effect of planting methods and forage crop combinations on economics of the crops

Treat. no.	Treatments details	Green fodder yield (qha^{-1})	Gross income (Rs.)	Cost of culti-vation (Rs. ha^{-1})	Net monetary returns (Rs. ha^{-1})	Maize fodder equivalent yield (q ha^{-1})	Benefit : cost ratio
T_1	Ridges and furrows, *Cenchrus ciliaris +Desmanthus virgatus*	763.11	87757	32228	55529.21	308.50	2.72
T_2	Ridges and furrows, *Cenchrus ciliaris +Stylosanthes seabrana*	664.78	76449	31646	44803.50	248.91	2.42
T_3	Ridges and furrows, *Dichanthium annulatum + Desmanthus virgatus*	456.83	52535	30548	21987.07	122.15	1.72
T_4	Ridges and furrows, *Dichanthium annulatum + Stylosanthes seabrana*	423.19	48666	30000	18666.46	103.70	1.62
T_5	Flat bed, *Cenchrus ciliaris +Desmanthus virgatus*	724.34	83299	32228	51071.43	283.73	2.58
T_6	Flat bed, *Cenchrus ciliaris +Stylosanthes seabrana*	649.53	74696	31646	43050.20	239.17	2.36
T_7	Flat bed, *Dichanthium annulatum + Desmanthus virgatus*	413.31	47531	30548	16982.72	94.35	1.56
T_8	Flat bed, *Dichanthium annulatum + Stylosanthes seabrana*	360.60	41469	30000	11468.71	63.72	1.38
				SE (m)±	651.07	3.62	0.02
				CD at 5%	1803.46	10.03	0.05

Conclusion

Based on the pooled data for four years (2009-12), it was concluded that the green fodder, dry matter & crude protein yields, net monetary returns, benefit cost ratio and maize fodder equivalent yield were significantly higher in treatment combination of planting *Cenchrus ciliaris* with *Desmanthus virgatus* in 1:1 proportion on ridges and furrows. The different planting methods + grasses & legume combinations also recorded higher level of organic carbon and available N, P, K in soil as compared initial status after completion of experiment under rainfed condition of Western Maharashtra. This technology is recommended for small & marginal farmers for cut & carries method of green forage under rainfed condition.

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