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Production Potential and Economics of Different Crops in Rice Fallows Under No Til Condition in Telangana Region of Andhra Pradesh

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ABSTRACT

A field experiment was conducted in clay loam soils of Regional Agricultural Research Station, Warangal during winter season of 2007-08, 2008-09 and 2009-10 to evaluate different crops in rice fallows under no til condition for their production potential and profitability on the same site. Higher maize equivalent yields (kg/ha) and net returns (Rs./ha) were recorded in maize crop followed by okra and mustard. However, more returns per rupee invested were realized with sunhemp crop followed by mustard, sorghum and castor compared to maize despite of their lower yields and net returns due to low cost of cultivation and/or more remunerative price for the economic produce.

Key words : Maize Equivalent Yield (MEY), No til condition, Post-rainy season crops, Returns per rupee invested, Rice fallows.

Rice-rice or rice-fallow is one of the predominant crop sequences in Telangana region of Andhra Pradesh. Of late, the growing limitation of water resources in irrigation command areas, tank fed and well irrigated areas demands for the crop diversification towards the cultivation of irrigated dry crops in post rainy season rice fallows (Reddy *et al*., 2006). Crop diversification has been recognized as an effective strategy for achieving the objectives of food security, nutrition security, income growth, poverty alleviation, employment generation, judicious use of land and water resources, sustainable agricultural development and environmental improvement (Hegde *et al*., 2003). Post-rainy season crops like blackgram, greengram, sunhemp, groundnut, mustard, cowpea and chickpea come up profitably in rainfed shallow heavy low land rice fallows with the utilization of residual soil moisture (Chandra, 2002; Kar and Kumar, 2009). These crops can also be taken up in the areas of long, frequent and erratic power cuts due to which ground water can not be exploited for cultivation during *rabi* season. Moreover, growing non paddy crops like maize during post rainy season has a special reference for efficient utilization of irrigation water, labour and other inputs for higher productivity, profitability and food security.

Tillage practices contribute greatly to the labour cost and energy input in any crop production system resulting in lower economic returns (Jat *et al*., 2005). Intensive tillage systems also result in increased soil compaction, decreased soil organic matter and biodiversity. Further, achieving proper tilth for irrigated dry crops after rice takes longer time. Hence, conservation tillage practices such as zero and minimum tillage are gaining more attention in recent years. Adoption of no-till helps in timeliness of sowing each crop in rotation, and hence leads to increase in productivity (Mohammad, 2009). The selection of the irrigated dry crop in rice fallows should be suitably planned based on the soil type, residual moisture, time of harvest of rice crop, irrigation facilities and prevailing market price for the efficient utilization of resource base and to increase overall productivity and profitability. Hence an effort was made to evaluate different crops in rice fallows under no til condition for their production potential and economics in Telangana region of Andhra Pradesh.

MATERIAL AND METHODS

Field experiment was conducted for three years during winter season of 2007-08, 2008-09 and 2009-10 in rice fallows at the Regional Agricultural Research Station, Warangal, Central Telangana Zone, Andhra Pradesh on the same site. The soil was clay loam with a P^H of 7.9 and EC of 0.2 d Sm^{-1}, low in organic carbon (0.3%) and available N (260 kg ha^{-1}), medium in available P_2O_5 (29 kg ha^{-1}) and available K_2O (292 kg ha^{-1}). The experiment

was laid out in a randomized block design comprising of eight crops during 2007-08 and nine crops during 2008-09 and 2009-10 replicated thrice (Table 1).

Chickpea, safflower, maize, sorghum, sunflower, castor, okra and clusterbean were sown by dibbling under zero tillage after harvest while sunhemp, mustard, greengram and blackgram were sown as relay crops three days before harvest of *kharif* rice. Coriander and sesame were sown in rice fallows during 2007-08 with minimum tillage by rotavator. All the cultivation practices for the crops studied were followed as per the recommendation in the region during *rabi* season in each year. Crop wise varieties, time of sowing and harvesting and weather data (mean minimum and maximum temperature, rainfall and rainy days) observed during the study period in different crops is furnished in Tables 2 - 4. Three irrigations to maize, two irrigations each to sorghum, sunflower and okra and one irrigation to castor and clusterbean were given during 2008-09 and 2009-10. Economic yields of different crops were converted into Blackgram Equivalent Yield (BEY) during 2007-08 and Maize Equivalent Yield (MEY) during 2008-09 and 2009-10 taking into account the prevailing market price (Rs./kg) of the crops during the respective years.

Blackgram or Maize Equivalent Yield =
(BEY or MEY (kg ha^{-1}))

$$\frac{\text{Yield of crop (kg ha}^{-1}\text{) x Price of crop (Rs kg}^{-1}\text{)}}{\text{Price of Black gram or Maize (Rs. kg}^{-1}\text{)}}$$

RESULTS AND DISCUSSION

On observing the data , it was revealed that during 2007-08, among the different crops tried in rice fallows, significantly higher blackgram equivalent yield (kg ha^{-1}) was recorded with mustard (819) than other crops except safflower (762) and blackgram (661) which were also at par with each other (Table 5). Similarly more net returns (Rs. /ha) were obtained with the mustard crop (Rs.16, 743/- per ha) followed by safflower (Rs.14, 099/- per ha) and blackgram (Rs.12, 909/- per ha). Reddy *et al*. (2006) also found that rice followed by mustard and blackgram relay crop sequence was more remunerative compared to sorghum or greengram. However, more return per rupee invested (Rs.) was obtained with sunhemp crop (2.46) despite of lower net returns compared to mustard (2.39) and blackgram (2.07). This is due to low cost of cultivation in sunhemp (Rs. 5000/- per ha) compared to mustard (Rs. 7,000/- per ha) and blackgram (Rs. 6,250/- per ha).

During 2008-09, it was the maize crop which recorded the highest economic yield as well as maize equivalent yield (5096 kg ha^{-1}) compared to all the other crops. It was followed by okra (4280 kg ha^{-1}) and blackgram (3786 kg ha^{-1}), which were at par with each other (Table 6). The performance of sorghum (1592 kg ha^{-1}), greengram (2748 kg ha^{-1}) and castor (2750 kg ha^{-1}) was found to be poor. The net returns (Rs. ha^{-1}) obtained also followed the similar trend. Kumar *et al*., (2005) and Murthy *et al.,* (2006) also reported the higher yields and net returns with maize crop in rice fallows. The returns per rupee invested (Rs.) during 2008-09 also followed the same trend as that observed in 2007-08. Highest returns per rupee invested were realized with sunhemp crop (3.20) followed by mustard (3.17) even though highest maize equivalent yield (kg ha^{-1}) and net returns (Rs.ha^{-1}) were observed with maize crop. The reason attributed is the low cost of cultivation

Table1. Crops studied in rice fallows year wise.

2007-08	2008-09	2009-10
T_1: Su hemp	T_1: Sunhemp	T_1: Sunhemp
T_2: Mustard	T_2: Mustard	T_2: Mustard
T_3: Green gram	T_3: Green gram	T_3: Green gram
T_4: Black gram	T_4: Black gram	T_4: Black gram
T_5: Chickpea	T_5: Maize	T_5: Maize
T_6: Safflower	T_6: Sorghum	T_6: Sorghum
T_7: Coriander	T_7: Sun flower	T_7: Sun flower
T_8: Sesame	T_8: Castor	T_8: Castor
	T_9: Okra	T_9:Cluster bean

coupled with high market price for these crops. It was also observed that the return per rupee invested was more with castor (2.76) and okra (2.19) despite of low MEY (2750 kg ha^{-1}) and net returns (Rs. 16,568/- per ha) in castor crop.

The performance of maize crop under no til condition in rice fallows was superior to other crops with respect to crop yield (kg ha^{-1}) and maize equivalent yield (kg ha^{-1}) during 2009-10, as well (Table 7).

In general, the yield of all the crops studied was less during 2009-10 compared to 2008-09. This might be due to the low mean temperatures prevailed during the crop growth period. However, the performance of sorghum crop was better compared to previous year. With regard to net returns, maize and sorghum gave almost equal net returns (Rs.19, 588/- and 19,290/- per ha, respectively). It was followed by mustard (Rs.17, 800/- per ha). Higher net returns from sorghum and mustard despite of their lower yields than maize is due to their lower cost of cultivation under no til condition. Similarly, mustard gave higher returns per rupee invested (2.97) followed by sorghum (2.84), sunhemp (2.11)

Table 2. Treatment details during 2007-08.

Crop	Variety	Date of sowing	Date of harvesting	Duration (days)	Mean min. temp. (C^0)	Mean max. temp. (C^0)	Rainfall (mm)	Rainy days
T_1: Sunhemp	Local	05.11.07	15.02.08	102	17.3-19.9	29.5-32.3	14.9	2
T_2: Mustard	GM-1	05.11.07	08.02.08	95	14.5-19.9	31.0-32.3	-	-
T_3: Green gram	WGG-37	05.11.07	19.01.08	75	19.1-19.9	31.0-32.3	-	-
T_4: Black gram	LBG-645	05.11.07	30.01.08	86	19.2-19.9	31.0-32.3	-	-
T_5: Chickpea	KAK-2	09.11.07	19.02.08	102	17.8-19.7	31.0-32.2	14.9	2
T_6: Safflower	Manjira	09.11.07	18.03.08	130	18.5-22.2	31.0-33.6	14.9	2
T_7: Coriander	Sadhana	01.01.08	15.04.08	106	17.8-19.9	31.0-32.2	190.5	8
T_8: Sesame	Swetha	01.01.08	01.04.08	91	19.7-26.9	31.3-34.1	14.9	2

Table 3. Treatment details during 2008-09.

Crop	Variety	Date of sowing	Date of harvesting	Duration (days)	Mean min. temp. (C^0)	Mean max. temp. (C^0)	Rainfall (mm)	Rainy days
T_1: Sunhemp	Local	11.11.08	20.02.09	101	19.2-22.1	29.3-33.3	-	-
T_2: Mustard	GM-1	11.11.08	14.02.09	93	19.2-22.1	29.3-33.2	-	-
T_3: Green gram	WGG-37	11.11.08	26.01.09	76	19.2-22.1	29.3-31.5	-	-
T_4: Black gram	LBG-645	11.11.08	03.02.09	84	19.2-22.1	29.3-34.4	-	-
T_5: Maize	Dekalb Super 900M	15.11.08	10.03.09	115	19.2-22.6	29.3-36.4	-	-
T_6: Sorghum	PSV-1 275 PR	15.11.08	05.03.09	110	19.2-22.6	29.3-36.4	-	-
T_7: Sunflower	Sunbred-Kranthi	15.11.08	15.02.09	92	19.2-22.6	29.3-33.2	-	-
T_8: Castor		15.11.08	13.04.09	149	19.2-24.0	29.3-39.7	3.6	1
T_9: Okra	Mahyco No.10	15.11.08	12.02.09	89	19.2-22.6	29.3-33.3	-	-

Table 4. Treatment details during 2009-10.

Crop	Variety	Date of sowing	Date of harvest-ing	Duration (days)	Mean min. temp. (C^0)	Mean max. temp. (C^0)	Rain-fall (mm)	Rainy days
T_1: Sunhemp	Local	18.11.09	01.03.10	103	14.9-25.8	27.7-32.0	36.8	4
T_2: Mustard	GM-1	18.11.09	22.02.10	96	14.9-19.4	27.7-31.0	32.7	3
T_3: Green gram	WGG-37	18.11.09	03.02.10	77	14.9-19.4	27.7-30.7	32.7	3
T_4: Black gram	LBG-645	18.11.09	13.02.10	87	14.9-19.4	27.7-30.9	32.7	3
T_5: Maize	Dekalb Super 900M	24.11.09	20.03.10	116	14.9-24.0	27.7-33.3	8.6	2
T_6: Sorghum	PSV-1	24.11.09	16.03.10	112	14.9-24.0	27.7-33.1	8.6	2
T_7: Sunflower	Sunbest-99	24.11.09	25.02.10	93	14.9-18.8	27.7-33.9	4.5	1
T_8: Castor	Kranthi	24.11.09	26.04.10	153	14.9-25.6	27.7-39.3	8.6	2
T_9:Cluster bean	Anuradha-51	24.11.09	24.02.10	92	14.9-18.8	27.7-33.9	8.6	2

Table 5. Production potential of different crops in rice fallows during 2007-08.

Treatments	Economic yield (kg ha^{-1})	BEY (kg ha^{-1})	Net Returns (Rs. ha^{-1})	Returns per Rupee invested (Rs.)
T_1: Sunhemp	1237	597	12,313	2.46
T_2: Mustard	1250	819	16,743	2.39
T_3: Greengram	552	476	7,800	1.30
T_4: Blackgram	661	661	12,909	2.07
T_5: Chickpea	260	216	748	0.14
T_6:Safflower	1052	762	14,099	1.76
T_7: Coriander	298	164	763	0.19
T_8: Sesame	262	208	526	0.10
SEm±	-	63	-	-
CD(P=0.05)	-	192	-	-

Price (Rs/kg): Sunhemp: 14, Mustard: 19, Greengram: 25, Blackgram: 24, Chickpea: 24, Safflower: 21, Coriander: 16 and Sesame: 23

Cost of Cultivation (Rs/ha): Sunhemp: 5,000, Mustard: 7,000, Greengram: 6,000, Blackgram: 6,250, Chickpea: 5,500, Safflower: 8,000, Coriander: 4,000 and Sesame: 5,500

and castor (2.11) compared to maize crop (1.35). These results corroborate the findings of Bastia *et al*., (2008) and Jat *et al*., (2011).

Based on the findings of this experiment it can be concluded that under no til condition in rice fallows, maize crop gave highest equivalent yields (kg ha^{-1}) and net returns (Rs. ha^{-1}) followed by okra and mustard in clay loam soils. However, more returns per rupee invested (Rs.) was realized with sunhemp crop followed by mustard, sorghum and castor compared to maize due to their less cost of cultivation and remunerative market price. If there is a possibility for providing 2-4 irrigations, sorghum and maize can be grown while sunhemp, mustard and blackgram crops can be profitably grown with the residual soil moisture in black soils of rice fallows in Telangana region of Andhra Pradesh based on the prevailing market prices of the produce.

Table 6. Production potential of different crops in rice fallows during 2008-09.

Treatments	Economic yield (kg ha^{-1})	MEY (kg ha^{-1})	Net Returns (Rs. ha^{-1})	Returns per Rupee invested (Rs.)
T_1: Sunhemp	1053	2825	17,666	3.20
T_2: Mustard	1326	3556	22,172	3.17
T_3: Greengram	777	2748	14,533	1.82
T_4: Blackgram	1002	3786	22,562	2.65
T_5: Chickpea	5096	5096	26,746	1.78
T_6:Safflower	1088	1592	8,076	1.62
T_7: Coriander	1258	3373	17,676	1.77
T_8: Sesame	868	2750	16,568	2.76
T_9:Okra	3511	4280	24,110	2.19
SEm±	-	181	-	-
CD(P=0.05)	-	542	-	-

Price (Rs kg^{-1}): Sunhemp: 22, Mustard: 22, Greengram: 29, Blackgram: 31, Maize: 8.2, Sorghum: 12, Sunflower: 22, Castor: 26 and Okra: 10

Cost of Cultivation (Rs ha^{-1}): Sun hemp: 5,500, Mustard: 7,000, Greengram: 8,000, Blackgram: 8,500, Maize: 15,000, Sorghum: 5,000, Sunflower: 10,000, Castor: 6,000 and Okra: 11,000

Table 7. Production potential of different crops in rice fallows during 2009-10.

Treatments	Economic yield (kg ha^{-1})	MEY(kg ha^{-1})	Net Returns (Rs. ha^{-1})	Returns per Rupee invested(Rs.)
T_1: Sunhemp	555	1895	10,540	2.11
T_2: Mustard	680	2901	17,800	2.97
T_3: Greengram	449	2736	14,250	1.74
T_4: Blackgram	467	2561	12,415	1.44
T_5: Chickpea	4157	4157	19,588	1.35
T_6:Safflower	2609	3182	19,290	2.84
T_7: Coriander	566	1518	3,452	0.38
T_8: Sesame	790	2504	13,940	2.11
T_9:Okra	1313	1601	4,130	0.46
SEm±	-	196	-	-
CD(P=0.05)	-	586	-	-

Price (Rs kg^{-1}): Sun hemp: 28, Mustard: 35, Greengram: 50, Blackgram: 45, Maize: 8.2, Sorghum: 10, Sunflower: 22, Castor: 26 and Cluster bean: 10

Cost of cultivation (Rs ha^{-1}): Sun hemp: 5,000, Mustard: 6,000, Greengram: 8,200, Blackgram: 8,600, Maize: 14,500, Sorghum: 6,800, Sunflower: 9,000, Castor: 6,600 and Cluster bean: 9,000

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