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Identification of profitable Rabi crops for high altitude areas of Andhra Pradesh

D SEKHAR, K TEJESWARA RAO and N VENUGOPALA RAO

Regional Agricultural Research Station, Chintapalli 531111 Andhra Pradesh
Email for correspondence: sekhardesagiri@gmail.com

ABSTRACT

High altitude areas in Andhra Pradesh are located at eastern Ghats which spread in Srikakulam, Vizianagarm, east Godavari, Khammam and Visakhapatnam districts. The above area lies in an altitude ranging from 260-1400 m amsl with minimum temperature ranging from 2-15^{o}C during Rabi season. It consists of variable landscape from wide plains to rolling hill ranges covered with dense vegetation and valleys. The sloppy lands and valley areas are covered with plantation crops like coffee and rubber while in the low lying areas rice is cultivated predominantly. Mixed cropping is a common practice followed in upland areas comprising cereals, millets, pulses and condiments. Due to continuous mono-cropping, erratic rainfall, delayed monsoons, increased pest and disease incidence the farmers are realizing low yields. Introduction of alternate crops in Rabi season which come up well in cool climatic conditions may be profitable to the farming community in high altitude tribal areas. Hence different alternate crops comprising of wheat, barley, safflower, mustard, sunflower and linseed were evaluated during Rabi season at Regional Agricultural Research Station, Chintapalli, AP during 2009-2012 with a view to introduce suitable alternate crops for sustainable production and profitability for small and marginal farmers. Among the above mentioned crops higher benefit:cost ratio was observed with wheat crop (2:64) followed by mustard (2.25), sunflower (1.78), linseed (1.39), barley (1.12) and safflower (1.09) and traditional Rajmash crop (1.94). Diversification with profitable crops during Rabi season in the existing cropping pattern can sustain the livelihood agriculture in high altitude areas of Andhra Pradesh.

Keywords: Rabi crops; yield; energetic; economics; nutrient status

INTRODUCTION

Introduction of profitable crops is generally considered as a shift from traditionally grown less remunerative crops to more remunerative crops. Market infrastructure development and certain other price related supports induce crop shift. Crop diversification and also the growing of large number of crops are practiced in rainfed lands to reduce the risk factor of crop failures due to drought or shortage of rainfall. Crop substitution and shift are also taking place in the areas with distinct soil problems.

Cropping system investigations play an important role in utilizing the inputs in a synergistic manner. Continuous cropping with the same crop over years is widely regarded as high risk system unlikely to be sustainable because of probable build up of adverse biotic factors. Crop diversification has been identified as an important and essential strategy to improve farm income and soil and environmental health consistently. Viable cropping system with new rewarding crops should infuse new opportunities and challenges and demonstrate the potential for land productivity with efficient resource use. Identification of appropriate crop in a system may help to achieve more returns and maximum input use efficiency by developing cohesion among the resources applied. Diversification of cropping system is necessary to get higher yield, returns, maintain soil health, preserve environment and meet daily requirement of human and animals (Samui et al 2004). Continuous adoption of same cropping sequence over years results in declining the efficiency and productivity of the system (Kumar and Yadav 2005). As Rajmash is predominantly grown as Rabi crop over years in uplands of tribal areas of high altitude zone of Andhra Pradesh it is thought to be worth to study different alternate crops during Rabi in comparison to traditional Rajmash crop to identify a profitable and efficient crop for high altitude and tribal areas of Andhra Pradesh.

MATERIAL and METHODS

Field experiments were conducted for three consecutive years during Rabi season of 2009-10, 2010-11 and 2011-12 at Regional Agricultural Research Station, Chintapalli, Andhra Pradesh. The soil was sandy clay loam having pH 6.8, organic carbon 0.65 per cent, available nitrogen 245 kg/ha, available P_2O_5 25.8 kg/ha and K_2O 295 kg/ha. The trial was laid out in randomized block design with four replications consisting of seven irrigated dry crops viz T_1- mustard (Varun), T_2- wheat (Sagarika), T_3- sunflower (NDSH-1), T_4- safflower (Sagaramutyalu), T_5- linseed (NL-142), T_6- barley (HBL-276) and T_7- Rajmash (CTPL Red). After harvest of Kharif maize field was ploughed thrice, thoroughly pulverized and then the Rabi crops were sown during 2nd week of October in all the three years of study and harvested as and when they were matured. Recommended cultivation practices were followed for the respective crops. Grains per seed and stover from the net plot were thoroughly sun dried to 14 per cent moisture content, weighed and expressed in kg/ha. Economic parameters like gross returns, net returns and rupee returned per rupee invested were worked out treatment-wise taking prevailing market rates for different inputs and outputs. Energetics was calculated as per the procedure given by Panesar and Bhatnagar (1994). Rajmash equivalent yield (REY), production efficiency (PE) and economic efficiency (EE) were calculated using the formulae given by Singh et al (2005). Value/cost ratio was worked out by dividing additional yield with additional expenditure. Nitrogen was estimated by modified Microkjeldahl method. The available P and K were estimated by Olsen et al (1954) and flame photometer (Jackson 1973) method respectively. Data were analyzed using ANOVA and the significance was tested by Fisher's least significance difference (p= 0.05) by pooling three years data.

RESULTS and DISCUSSION

The three years pooled data reveal that among different irrigated dry (ID) crops cultivated during Rabi on sandy clay loam soils wheat recorded the highest grain yield (4457 kg/ha) followed by barley (1621 kg/ ha), sunflower (1456 kg/ha), linseed and mustard (Table 1). Safflower was the only crop recording lower seed yield among the crops except control ie Rajmash. Stover yield was also significantly higher in wheat followed by sunflower. Similar results of higher yields of wheat and sunflower after Kharif rice have been reported by Reddy (2001). Rajmash equivalent yield was significantly higher in wheat (2139 kg/ha) followed by mustard and sunflower. In terms of Rajmash equivalent yield of barley recorded conspicuously lower values among different ID crops tested.

The highest production efficiency was recorded in wheat followed by mustard and sunflower while it was lowest in barley and safflower (Table 1). The economic efficiency was higher in wheat followed by mustard and sunflower. The economic efficiency was very low in barley and sunflower. Relatively higher production and profits in case of wheat, sunflower and mustard manifested the efficiencies among the test crops. Similar results of best performance of wheat, sunflower and mustard after Kharif rice were also reported by Kumar et al (2005).

Among different ID crops energy intake was higher in wheat followed by sunflower because of higher energy requirement through fertilizer by wheat and higher energy requirement through seed by sunflower. Energy output was higher in wheat, sunflower and mustard. Energy use efficiency was higher in wheat followed by sunflower and mustard while it was lowest in safflower and Rajmah (Table 2). Wheat recorded the highest energy productivity followed by sunflower whereas the energy productivity was lowest in safflower and Rajmash. These results are in corroboration with those of Parihar et al (1999).

The post-soil available nitrogen status was significantly declined with cultivation of wheat and sunflower after three years than initial status due to their exhaustive nature and higher nitrogen requirement (Table 1). There was no marked change in status of available phosphorus after three years of the study over initial with different test crops except wheat which shows that the current phosphorus application was not in line with the crop requirement and suggests slight

Table 1. Performance of different irrigated dry crops in terms of yield, efficiency and available N, P and K over three years

Crop	Grain/seed yield (kg/ha)	Stover yield (kg/ha)	Rajmash equivalent (kg/ha)	Production efficiency (%)	Economic efficiency (%)	Post-soil available status		
						N	P_2O_5	K_2O
T_1- mustard	1038	1429	1038	5.19	39.5	238	22.50	289
T_2- wheat	4457	4627	2139	9.72	90.9	203	20.15	266
T_3- safflower	1019	1190	407	1.85	2.98	240	24.68	282
T_4- sunflower	1456	2095	873	4.36	26.2	219	21.91	272
T_5- linseed	1150	1281	460	2.00	6.16	244	25.33	293
T_6- barley	1621	1855	324	1.47	2.49	239	25.17	285
T_7- Rajmash	954	1483	954	-	-	236	25.07	290
SE ± d	231	191	108	-	-	9.13	2.08	10.02
$CD_{0.05}$	480	398	233	-	-	19	4.33	21

Table 2. Performance of different irrigated dry crops in terms of energetic and economics over three years

Crop	Energy use efficiency (MJ/MJ)	Energy productivity (kg/MJ)	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
T_1- mustard	4.14	165	11500	25950	14450	2.25
T_2- wheat	6.94	472	20275	53484	33209	2.64
T_3- safflower	1.54	105	9300	10190	890	1.09
T_4- sunflower	5.30	212	12263	21840	9577	1.78
T_5- linseed	2.45	167	8250	11500	3250	1.39
T_6- barley	2.29	156	7195	8105	910	1.12
T_7- Rajmash	1.82	124	12250	23850	11600	1.94
SE ± d	-	-	1052	2641	512	0.09
$CD_{0.05}$	-	-	2188	5493	1065	0.19

increase in phosphorus dose over existing in case of wheat. The available potassium status was significantly declined with wheat and sunflower which shows the need of higher replenishment of potassium in double cropped areas. Cereal-cereal cropping sequences are more exhaustive and put heavy demand on soil resources as compared to cereal-legume and cereal-oilseed sequences (Bora et al 2011). Palaniappan and Sivaraman (1994) also reported the stability of soil health with inclusion of legume crops in double cropped areas.

Data on economics of different ID crops after maize on sandy clay loam soil reveal that wheat recorded significantly higher cost of cultivation than other crops while linseed recorded the lowest cost of cultivation (Table 2). Gross returns were significantly higher in wheat followed by mustard and sunflower. The higher gross returns were owing to higher yield in wheat and higher sale price in mustard. Net returns were significantly higher in wheat followed by mustard than all other crops besides Rajmash. The results are in agreement with those of Kumar et al (2005). Net returns of safflower, sunflower, linseed and barley were lesser than Rajmash. The benefit:cost ratio was also higher in wheat followed by mustard and sunflower while it was lowest in safflower and barley.

The results indicate that among different ID crops wheat, mustard and sunflower were the most viable options as these crops recorded higher yield, production efficiency, economic efficiency, energy productivity and benefit:cost ratio. However while selecting these crops efficient nutrient management is must to maintain soil fertility due to their exhaustive nature.

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