Indian J Hill Farmg 12 (1 & 2) : 106–110 (1999)

Performance of Cropping Systems Under Mid Altitude Rainfed Dry Terraces of Meghalaya

G. C. Munda, U. K. Hazarika, D. C. Saxena, Raj Singh and D. P. Patel
ICAR Research Complex for NEH Region, Umiam-793103 (Meghalaya)

ABSTRACT

A field experiment was conducted during the year 1990-93 to assess the productivity and economics of different cropping systems under mid altitude (950-1080 m msl) rainfed dry terraces of Meghalaya. Maize (*Zea mays* L.) green cobs-groundnut (*Arachis hypogea* L.) - Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] cropping system gave maximum maize equivalent yield (118.98 q/ha) as well as higher economic return (Rs. 13,550/ha). Though major cereal food crop, rice (*Oriza sativa* L.) proved uneconomic, groundnut proved stable and most profitable (Rs. 8,250/ha). Popcorn was also profitable under such situations (Rs. 7,940/ha). Intercropping systems with rice (4:2)and maize (2:2) were more productive (22.8 and 26.6 q/ha) than sole cropping of rice (20.2 q/ha) and maize (22.6 q/ha). Higher cropping intensity (300%) was also obtained under rainfed dry terraces with short duration crop varieties [maize (Vijay composite), groundnut (Grinar-1) and mustard (M-27)].

INTRODUCTION

The low productivity of food crops and low cropping intensity are the main factors responsible for deficit of food grains in the region. Cultivable land is mostly upland (flat land and hill slopes) having problem of aluminium toxicity, low water- retention capacity, nutrient deficiency (P, Zn and B) and undulating topography which are responsible for poor yield of crops. In mid-altitude hills, rice and maize are the major food crops grown rainfed during rainy season. During winter season very limited area is put under second crop leading to low cropping intensity. The present cropping intensity of 117.42% has to be increased by introducing high yielding short duration oil seed and pulses crop varieties along with their appropriate package of practices to increase production and productivity per unit area per unit time. Based on this background, promising varieties of upland rice, maize or popcorn and other potential crops like french bean (Phaseolus vulgaris L.), sunflower (Helianthus annuus) and Indian mustard were grown in different combination to study productivity and net return under the mid-altitude (980-1080 m msl) rainfed dry terraces of Meghalaya.

MATERIALS AND METHODS

Field experiments were conducted during 1990-93 at ICAR Research Complex, Barapani farm (980 m msl). The soil was alfisol, acidic (pH 5.2) having organic carbon 0.83 %, total soil N 560 kg/ha, available P 6.23kg/ha and K 303.75 Kg/ha. The mean annual rainfall for the period was 2235 mm. The experiments consisting of 12 treatments of various cropping systems such

as T-1: Maize (Vijay composite) for fodder- rice (IRAT-141) + groundnut (Girnar-1), Indian mustard (M-27), T-2: Maize (for green cobs)–rice -Indian mustard, T-3: Maize for fodder- rice-Indian mustard, T-4: Maize (for green cobs) -rice+ groundnut (4:2) -Indian mustard, T-5: Maize (for green cobs)- groundnut-Indian mustard, T-6: Maize for fodder-groundnut- Indian mustard, T-7: Maize (Popcorn) -sunflower(Morden)- Indian mustard, T-8: Maize (popcorn) -groundnut + sunflower (2:2)-Indian mustard, T-9: Maize (grain)- Indian mustard, T-10: Maize (grain) + groundnut (2:2)- Indian mustard, T-11: Maize (green cobs)- french bean (Contender) and T-12: Maize (grain) + french bean (2:2) - french bean - Indian mustard were laid out in a randomised block design with 3 replications.

The doses of fertiliser applied were, maize : 100:60:40, rice and french bean; 60:60:40, Indian mustard and sunflower; 50:40:30 and groundnut : 20:60; 40 N, P, K Kg/ha respectively. Pre-rainy season crops like maize for fodder/ green cobs/ grain and popcorn, maize for grain + groundnut/french bean were sown in the month of March and were harvested in the month of May, June and July respectively. Rainy season crops like rice + groundnut and groundnut after maize fodder were sown in the month of May and harvested in September, rice, rice + groundnut and groundnut after maize fodder and maize green cobs were sown in the month of June and harvested in October, sunflower, french bean were sown in the month of July and harvested in the month of October. Winter season crop indian mustard was sown in the month of October after harvest of rainy season crops and was harvested in the month of February. The same schedule of sowing and harvesting of crops was followed in every year.

All the recommended agronomical practices were followed for different crops. Fertiliser dose was calculated for main crops and no additional fertiliser was given to inter crops. The inter crops were grown in replacement series. The data on the yield of all crops was converted into maize grain equivalent yield. The monetary values of crops were estimated depending upon the prevailing market price of the area. The maize grain equivalent yield of all the crops of all the years were analysed.

RESULTS AND DISCUSSION

Performance of cropping system

The highest (11.89 t/ha) grain yield in terms of MEY was obtained by maize for green cob-groundnut- indian mustard cropping sequence (Table-1). Inclusion of maize (popcorn) in maize (popcorn)-sunflower + groundnut- Indian mustard cropping sequence recorded 11.05 t/ha which was the second best cropping sequence. It is likely that high price and yield of popcorn was responsible for increasing the MEY. Maize fodder- groundnut -Indian mustard also produced 24.2, 2.2 t and 0.6 t/ha respectively and was third in sequence. Chatterjee *et al.,* (1978) also reported that inclusion of forage crops can provide 37.5 to 45 t/ha forage in addition to normal yield of two arable crop. However, there was very little scope for the sale of fodder in the local market. Inclusion of groundnut as inter crop in maize proved stable for increasing the MEY. Malvia et al., (1986) also reported similar results. Maize for grain either sole or in inter cropping system did not show promising results. Maize grain- Indian mustard and maize grain + groundnut- Indian mustard recorded lowest equivalent yield due to low cropping intensity and lower

yield levels of maize grain and indian mustard. Rice + groundnut was more productive than rice alone. Inclusion of french bean and sunflower in the cropping system either sole or in intercropping did not perform well. Indian mustard performed almost uniformly in all the cropping sequences tested.

Performance of individual crops

Among all the crops grown either sole or as the inter crop in different cropping sequences, groundnut proved the most promising crop giving maximum net return (Rs 8250 /ha) Table-2. Patel *et al.,* (1986) also reported higher potentiality in groundnut in upland terraces than the existing major cereal crops viz; maize and rice. Among the maize crops grown for different purposes (fodder, green cobs, popcorn and grain), popcorn maize although gave moderate yield was promising with higher net return of Rs. 7940/ha, ranking next to groundnut. Maize grown for green cob appeared promising with a good market and recorded a net profit of Rs. 5514 / ha. The remaining crops, maize (grain), sunflower, rice, french bean and mustard were unremunerative due to their poor yield. However, high yielding suitable variety of french bean is very much desirable in the cropping sequence as this crop has tremendous demand as a vegetable crop in the state.

Economics of cropping system

The analysis of pooled data of 4 years on grain yield in terms of MEY and net return revealed that maize green cobs- groundnut -indian mustard sequence with 300 % cropping intensity was most productive and profitable (Rs.13550/ha) among all the sequences tested (table-3). Maize popcorn- sunflower + groundnut- Indian mustard gave a net return of Rs. 10955 /ha and ranked second in the cropping sequence. Inclusion of maize as fodder in maize - groundnut-indian mustard cropping sequence also gave higher yield and net return, but due to lack of demand for fodder in the state it could not be a promising sequence. The net return of Rs. 6990 /ha was obtained by maize green cob - french bean -mustard which could be more remunerative as all the crop in the sequences have good demand. Thus, cultivation of maize in the cropping sequence was inferior and the crop must be grown in mixed stand with suitable intercrop such as groundnut. Similarly, upland rice in mixed stand produced more maize equivalent yield than rice (sole).

REFERENCES

Chatterjee B. N., Mukharjee, A. K., Bhattacharya, K. K., Mandal, S. R., Rana, S. K. and Mandal, B. K. (1978). Production potential of forage cropping systems and their effects on soil and crop productivity in the Gangetic planes of Eastern India. Forage Research 4: 73-80.

Malvia, D. D., Sinha, M. P., Vyas, M. N., Patel, J. C. and Kalara, K. S. (1986). Production potential and economic feasibility of different crop sequences. Indian *J. Agron.* 31 : 75-78.

Patel, C. S., Munda, G. C. and Singh, R. P. (1986). Groundnut a highly potential crop for Meghalaya. *Indian Fmg.* 36 : 21-25.

Table 1. Yield of individual crop component and maize equivalent yield of cropping systems

Cropping systems	Yield t/ha/ maize (GC) 000, /ha									
	Maize (F)	Rice	Groundnut	Mustard	Maize (GC)	Maize (G)	Maize (PC)	Sunflower	French bean	Maize equivalent yield (t/ha)
Maize (F)- rice+ groundnut- mustard	23.50	1.60	0.68	0.50						7.97
Maize (GC)- rice- mustard		2.10		0.61	42.00					8.67
Maize (F)-rice- mustard	25.10	1.95		0.56						6.64
Maize (GC)- rice+ groundnut- mustard		1.80	0.48	0.49	39.25					8.99
Maize (GC)- groundnut- mustard			1.90	0.54	48.50					11.89
Maize (F)-groundnut- mustard	24.20		2.20	0.60						10.50
Maize (PC)-sunflower- mustard				0.58			1.90	0.62		9.68
Maize (PC)-sunflower+ groundnut- mustard			0.96	0.48			1.76	0.42		11.05
Maize (G)-mustard				0.65		2.26				4.34
Maize (G)-+ groundnut- mustard			0.79	0.57		1.87				5.90
Maize (GC)-french bean- mustard				0.47	45.20				1.36	8.75
Maize (G)+french bean- french bean- mustard				0.48		1.60			2.10	7.33
CD at 5%										0.80

Table-2. Economic performance of individual crop.

Crops	Yield (q/ha)/ green cobs No./ha	Gross returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)
Maize (Fodder)	242.67	60676	4700	1367
Maize (Green Cobs)	43737.00	10934	5420	5514
Maize (Grain sole)	22.60	5650	6100	–450
Maize (Popcorn)	18.30	14640	6700	7940
Rice (Sole)	20.25	6075	5535	540
Rice (Intercrop)	17.00	5100	4000	1100
Groundnut (Sole)	20.50	14350	6100	8250
Groundnut (Intercrop)	5.94	4158	2065	2073
Maize grain (intercrop)	17.35	4337	5300	–962
Sunflower (sole)	6.25	4375	5885	–1510
Sunflower (intercrop)	4.25	2975	2200	775
French bean (sole)	13.00	6500	4800	1700
French bean (intercrop)	11.00	5500	2750	2750
Mustard (sole)	5.50	4400	4675	–275

Prevailing market price (Rs.): Maize (F) - 25 /Q; Maize (GC) - 25 /100; Maize (G) - 250 /Q; Maize (PC)/ Mustard - 800 /Q; Rice - 300 /q; Groundnut/ Sunflower - 700 /Q; French bean (Green Pods) - 500 /Q.

Table-3. Yield and net returns as influenced by different cropping systems.

Cropping systems	Average maize equivalent yield (q/ha)	Gross returns	Cost of cultivation	Net returns
Maize (F)-rice+ groundnut-mustard	79.66	19915	15460	4455
Maize (GC)-rice-mustard	86.72	21680	15610	6070
Maize (F)- rice-mustard	66.42	16505	14910	1195
Maize (GC)-rice+ groundnut-mustard	89.97	22492	16180	6312
Maize (GC)-groundnut-mustard	118.98	29745	16195	13550
Maize (F)- groundnut-mustard	105.00	26250	15475	10775
Maize (PC)- sunflower-mustard	96.86	24215	17260	6955
Maize (PC)-sunflower+ groundnut- mustard	110.46	27615	16660	10955
Maize (G)-mustard	43.40	10850	10875	–25
Maize (G)-+ groundnut-mustard	59.06	14765	12060	2705
Maize (GC)-french bean-mustard	87.54	21885	14895	6990
Maize (G)+french bean-french bean- mustard	73.36	18340	17525	815