



## Evaluation of Various Cropping Systems under Canal Irrigation of Sriram Sagar Project Command

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### ABSTRACT

Demonstrations on different cropping systems were conducted during 1999 - 2004 under DBM - 26 of Kakathiya canal under Sriram Sagar Project in Warangal. Cultivation of mono crops of cotton, chilli, maize-maize was the usual farmers practice in the command. These systems have produced lower yield and net returns. In maize based systems, maize - chilli recorded significantly higher maize equivalent yield ( $17.4 \text{ t ha}^{-1}$ ) with net returns of Rs. 59,968/- per  $\text{ha}^{-1}$  followed by maize groundnut ( $10.1 \text{ t ha}^{-1}$ ) with net returns of Rs. 34,022 per ha. These systems were superior to maize - maize system. Similarly, in cotton based systems, cotton- ridge gourd recorded higher cotton equivalent yield ( $5.27 \text{ t ha}^{-1}$ ) with net returns of Rs. 52,023 /- per ha followed by cotton - cluster bean system ( $5.02 \text{ t ha}^{-1}$ ). In chilli based systems, chilli - bhendi recorded higher chilli equivalent yield ( $4.0 \text{ t ha}^{-1}$ ) followed by chilly - ridge gourd ( $3.87 \text{ t/ha}$ ) with higher net returns (Rs. 50,029/- per  $\text{ha}^{-1}$ ) followed by chilli - bhendi (Rs. 42,775/- per  $\text{ha}^{-1}$ ). Cultivation of vegetables in these systems increased net returns and utilized the irrigation water more efficiently.

**Key words:** Cropping systems, Equivalent yield, Net returns.

Under Sriram Sagar Project command area in Warangal district growing of mono cropping of cotton, chillies, maize-maize is the usual practice. These crop sequences multiply pest complex and utilize maximum irrigation water available in canal. Maize is grown in an area of 63,000 hectares under rainfed conditions with need based well irrigation in *Kharif* and in an area of 22,200 hectares under irrigated conditions in *rabi*. The crop is grown either for green cobs or for grain purpose. Due to less pest problems and assured market price, the crop is grown continuously in the same piece of land. This practice has reduced the maize yields due to depletion of soil nutrients. Inclusion of pulses in the sequence improves soil fertility status and stabilize the productivity of the system. Hence, different crops like groundnut, chillies, blackgram were tested after maize for getting higher returns.

The commercial crops like cotton in an area of 1,21,000 ha and chillies in 22,700 ha were grown as mono crops by farmers under irrigation. These crops are sown / transplanted in the month of July/August and harvested in March/April by farmers. This prolonged growing period has increased the incidence of pink boll worm in cotton and sucking pests in chillies, causing lower yields and poor quality of produce. Hence, it is suggested to harvest the crop in the month of January/February and grow vegetables in summer as crop rotation to reduce pest incidence and also to get additional income utilizing the water resources.

### MATERIAL AND METHODS

Different cropping systems were evaluated in farmers fields under Sriram Sagar Project command in Warangal district under canal irrigation for four years during 1999-2004. A total of 22 demonstrations in cotton, 18 demonstrations in maize and 7 demonstration in chillies were conducted on sandy loam and clay loam soils. Cotton varieties 'Brahma/Bunny' were sown during July with a spacing 90 cm x 90 cm with fertilizer dose of 150, 60, 40  $\text{kg ha}^{-1}$  of N,  $\text{P}_2\text{O}_5$  and  $\text{K}_2\text{O}$  respectively. Three pickings were taken upto January. Different vegetables like bhendi, ridge gourd, bitter gourd and cluster bean were sown during January/February after harvest of main crop. In bhendi, 'Mahyco' variety was grown at a spacing of 45 cm x 20 cm. A fertilizer dose of 100, 50, 50  $\text{kg N, P}_2\text{O}_5$  and  $\text{K}_2\text{O}$  was applied. Nitrogen in 3 splits - 1/3 before sowing, 1/3 on 30 DAS and 1/3 on 45 DAS, while phosphorus and potassic fertilizer as basal application. Irrigation was given at weekly intervals and picking of fruits started from 50 DAS at 5-6 days interval.

In ridge gourd 'Indam1222' or 'Surekha' (Hybrid), in bitter gourd 'Indam-711' 'Maduri' (Hybrid) and in cluster bean 'Ajeet 19' varieties were sown in the standing crop of cotton utilizing last irrigation. This system is useful in reducing cost on land preparation and the stubbles were utilized as support to these vegetables. A fertilizer dose of 25  $\text{kg phosphorus}$  was applied before sowing. Nitrogen 50  $\text{kg}$  was applied in two equal splits at

Table 1. Performance of different maize based cropping systems mean of 18 demonstrations (1999-2004)

Sequence	Yield (t ha <sup>-1</sup> )				Maize equivalent yield (t ha <sup>-1</sup> )		Net returns (Rs ha <sup>-1</sup> )	
	DP		FP		DP	FP	DP	FP
	Maize	Sequence	Maize	Maize				
		Crop	Kharif	Rabi				
Maize ground-nut	5.2	2.1	4.9	3.75	10.1* (T.cal-2.57) (T tab-1.47)	8.65	34022	26577
Maize chilli	5.6	3.5	5.0	4.27	17.4* (T.cal-12.7) (T tab-5.8)	9.27	59968	30253
Mean	5.4	-	4.95	4.01	13.78	8.96	46995	28415

DP- Maize - groundnut (240 days) / Maize - chilli (294 days)

FP- Maize - maize (252 days)

Rates considered for calculation(Rs. tonne<sup>-1</sup>): Maize - Rs. 5,000, Groundnut- Rs12,400, Chillies - Rs. 16,500

Table 2. Performance of different cotton based systems (mean of 22 demonstrations:1999-2004)

System	Yield (t ha <sup>-1</sup> )			Cotton equivalent yield (t ha <sup>-1</sup> )		Net returns (Rs ha <sup>-1</sup> )	
	DP		FP	DP	FP	DP	FP
	Cotton	Sequence	Cotton				
		Crop	alone				
Cotton-bhendi	2.6	7.5	2.80	4.84* (T cal-4.71) (T tab-2.23)	2.80	54839	32857
Cotton-ridge gourd	2.7	6.4	2.83	5.27* (T cal-2.48) (T tab-2.36)	2.83	52023	33013
Cotton-bitter gourd	2.5	5.1	2.65	4.81* (T cal-3.95) (T tab-2.57)	2.65	50738	27389
Cotton-cluster bean	2.7	7.0	2.97	5.02* (T cal-40.7) (T tab-4.3)	2.97	51141	30887
Mean	2.65	-	2.81	4.99	2.81	52185	31036

DP - Cotton - vegetable (288 days), FP - Cotton alone (242 days)

Rates considered for calculation (Rs.tonne<sup>-1</sup>): Cotton - Rs 20,000, Bhendi-Rs. 6,000, Ridge gourd-Rs. 8,000, Bitter gourd -Rs. 9,000, Cluster bean - Rs. 6,600.

Table 3. Performance of different maize based cropping system (mean of 7 demonstrations: 1999-2004)

Sequence	Yield (t ha <sup>-1</sup> )			Chilli equivalent yield (t ha <sup>-1</sup> )		Net returns (Rs ha <sup>-1</sup> )	
	DP		FP	DP	FP	DP	FP
	Chilli	Sequence Crop	Chilli alone				
Chilli-bhendi	2.0	5.50	2.45	4.0*	2.45	42775	24765
Chilli-ridge gourd	2.1	3.65	2.76	3.87*	2.76	50029	33605
Mean	2.05	-	2.65	3.94	2.65	46402	29185

DP-Chilli vegetables (298 days) FP- Chilli alone (264 days)

Rates considered for calculation(Rs.tonne<sup>-1</sup>):Chilli-Rs. 16,500, Ridge gourd-Rs. 8,000, Bhendi-Rs. 6,000

25 and 50 DAS. Irrigation was given at 8-10 days interval and picking of fruits started from 60-70 DAS at 15 days interval. Yield of both main crop and sequence crop (vegetables) were recorded and converted to equivalent yield for evaluation.

In maize based systems, maize cultivar pro agro - 4046/pioneer was sown in June second fortnight with a spacing of 60 cm x 20 cm adopting recommended fertilizer dose of 120, 60, 40 kg ha<sup>-1</sup> N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O respectively. Grain yield was recorded and land is prepared for sowing succeeding crop. Groundnut variety 'TMV2' was sown during October first fortnight at a spacing of 30 x 10 cm. Fertilizer dose of 30,50,40 kg ha<sup>-1</sup> @ N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O respectively and gypsum 500 kg ha<sup>-1</sup> at flowering stage were given. Irrigation was given at 15 days interval. Pod yield was recorded after harvest of crop.

In chilli crop with variety "wonder hot" or LCA 302' was transplanted in the second fortnight of September after *khari* maize. A spacing of 75 cm x 45 cm with fertilizer dose of 60, 60, 30 N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O and Neem seed Kernel @ 300 kg ha<sup>-1</sup> was applied. Irrigation was given at 10 days interval. Pod yield was recorded in 3-4 pickings.

In chilli based systems, chilli varieties 'wonder hot' / 'Red Sun' was sown during 1st fortnight of July and transplanted during 2 nd

fortnight of September. Application of 200, 60, 80 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was applied. Irrigation was given during post rainy season from November to February at 20 days interval. Pod yield was recorded upto February followed by land preparation and sowing of different vegetable crops. The yield of vegetables were also recorded from different pickings.

The equivalent yields recorded was analysed for paired 't' test.

#### a) Maize based system:

Maize-chilli recorded significantly higher maize equivalent yield (17.4 t ha<sup>-1</sup>) with net returns of Rs. 59968 ha<sup>-1</sup> (Table1) which was followed by maize-groundnut (10.1t ha<sup>-1</sup>) cropping system with net returns of Rs.34,022 ha<sup>-1</sup>. The farmers practice of cultivating maize -maize recorded lower mean maize equivalent yield of 8.96 t ha<sup>-1</sup> and net returns of Rs. 28,415 ha<sup>-1</sup>. Chourdhary *et.al.*, (2000) reported higher net returns with maize raidsh - onion and maize - toria - potato involving oilseeds and vegetables. This was due to inclusion of commercial crops like chilli which increased returns from the system. Similarly inclusion of groundnut was also beneficial in this system, as the pulse crop grown in sequence with cereal improves soil fertility (Ghosh and Singh, 1994).

**b) Cotton based systems:**

Cotton - vegetable cropping systems recorded significantly higher cotton equivalent yield than cotton alone (Table 2). Highest equivalent yield was recorded by cotton - ridge gourd (5.27 t ha<sup>-1</sup>) followed by Cotton -cluster bean ( 5.02 t ha<sup>-1</sup>). The net returns were higher in Cotton - bhendi (Rs. 54839 ha<sup>-1</sup>) followed by Cotton - ridge gourd (Rs.52023 ha<sup>-1</sup>) cropping systems. All the systems were superior in obtaining higher equivalent yield compared to cotton alone. If the canal water is available upto March, then cotton - vegetable systems are profitable than prolonging the cotton crop with lesser yeild with poor quality of cotton. The incidence of pink boll worm was higher in the system where cotton was grown alone. However, fluctuations in market prices of vegetables will influence the net returns recorded in the sequence.

**c) Chilli based systems:**

In chilli based cropping systems, Chilli - bhendi recorded significantly higher chilli equivalent yield (4.0 t ha<sup>-1</sup>) followed by Chilli - ridgegourd (3.87 t ha<sup>-1</sup>). On the other hand, the net returns were higher with Chilli - ridge gourd (Rs.50,029 ha<sup>-1</sup>)

followed by Chilli- bhendi (Rs. 42,775 ha<sup>-1</sup>) cropping systems. Both these systems were superior to chilli alone. Cultivation of mono crop of chilli upto March/ April decreased the net returns due to severe disease incidence resulting in low yield.

The cultivation of vegetables during summer after chilli recorded higher yield and utilized the water more efficiently than cultivation of chilli alone. If water is available up to April, under canal supported by wells, these systems were more profitable than cultivation of chilli alone.

**LITERATURE CITED**

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