



## Evaluation of Zero Tillage Technology in Maize – a Case Study in Warangal District of Andhra Pradesh

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### ABSTRACT

This study has been under taken to evaluate the zero tillage method of maize cultivation in Mandaripet village in Warangal district in Andhra Pradesh. This study analyses the contribution of zero tillage as a technology towards the net returns of Maize. The collected data were analyzed for costs and returns through averages and percentages, for input use efficiency through Multiple Linear Regression (MLR) and for evaluation of zero tillage practices in Maize as a technology through introducing a dummy into regression analysis. The results of the study revealed that Zero tillage technology saves on an average Rs.5035 required for land preparation when compared to conventional *rabi* rice cultivation. Zero tillage practices as a technology in Maize was resulted in significant increase of net returns ranging from Rs. 9553 to Rs.16725 per hectare in the study area.

**Key words :** Economics of zero tillage, Maize, Zero tillage.

Farmers of Mandari pet village in Warangal district practice Rice-Rice Monoculture. In recent years, they are facing the problem of erratic and insufficient rainfall in *kharif*, out break of pest and diseases, increased machinery and labour costs for field preparation and other agricultural operations. Poor discharge of water from the wells/bore wells at the critical period of rice is a recurring phenomenon resulting in low grain yields. Low minimum support price of rice has put a question mark on *rabi* rice cultivation in the area. At last, they came across the zero tillage technology introduced by Regional Agricultural Research Station, Warangal. The main advantage of the technology, is saving of field preparation charges, allows short duration summer crops, reduces soil erosion, conserves soil moisture and minimizes labour and fuel consumption. Water sufficient for one acre of rice can be utilized for cultivating at least one hectare of maize. With increased area of maize cultivation, higher net monetary returns can be realized. The technology was demonstrated to the farmers at research station in dry season of 2005-06 and in the farmers fields in *rabi* 2006-07. Subsequently many farmers expressed their willingness to adopt the zero tillage maize in 2007-08 in place of *rabi* rice.

In this context, a study has been under taken to evaluate the zero tillage method of maize cultivation with the following objectives.

1. To study the costs and returns of maize cultivation with special reference to zero tillage method.

2. To study the contribution of zero tillage as a technology towards the net returns of Maize.

### MATERIAL AND METHODS

The Mandaripet village in Warangal district of Andhra Pradesh was purposively selected due to its proximity to the research station and the willingness of the farmers in the village to adopt the technology as the Regional Agricultural Research Station, Warangal of Acharya N.G.Ranga Agricultural University has introduced Maize crop in place of *rabi* rice. The expenditure on land preparation, sowing, manures and fertilizers, herbicides, weeding, seeds, harvesting and threshing pertaining to 2007-08 were collected from 40 farmers who have cultivated maize in place of rice in *rabi*. The collected data were analyzed for costs and returns through averages and percentages, for input use efficiency through Multiple Linear Regression (MLR) and for evaluation of zero tillage practices in Maize as a technology through introducing a dummy into regression analysis.

In order to understand the factors affecting the net returns of maize, a linear regression model in the form of following equation was fitted. The data were analyzed with SPSS 12.0 statistical package.

$$Y = f ( X_1, X_2, \dots, X_n, D_1 )$$

Where, Y is the net returns of Maize and different combinations of independent variables such as expenditure incurred on land preparation,

sowing, fertilizers and plant protection chemicals, weeding, seeds, harvesting and threshing, manual labour and machine labour expressed in terms of rupees, are  $X_1, X_2, \dots, X_n$  respectively.  $D_1$  is the dummy for tillage methods i.e., Zero tillage = 0, otherwise = 1. Maize sowed by hand dibbling immediately after harvest of *kharif* rice without land preparation was considered as zero tillage technology. The dummy was supposed to evaluate the contribution of the tillage method towards the net returns of the Maize.

### RESULTS AND DISCUSSION

The results of costs and returns analysis are presented in the Table 1. A perusal of the table revealed that the total operational cost per hectare of maize under zero tillage was Rs. 14027. The expenditure on fertilizers and plant protection chemicals (44.87%) accounted for the highest share in total operational costs of maize under zero tillage technology followed by harvesting (17.74%), sowing (14.91%), Seeds (13.51%), and Weeding (6.88 %). The gross returns and net returns per hectare were Rs. 60887 and Rs. 46860 respectively. Comparable results were obtained in the experiment conducted at Mahabubnagar, where 3.8 tonnes per hectare of maize was realised by adopting zero tillage method (The Hindu, 2007).

The cost benefit ratio worked out to be Rs. 3.34 which indicated that the maize crop under zero tillage in *rabi* ensures at least Rs. 3.34 of net profit on every rupee invested. It saves on an average Rs.5035 required for land preparation when compared to conventional method of *rabi* rice cultivation. The results are in coincidence with the result of adoption of zero tillage technology in the Punjab state where the farmers have saved a sum of about Rs. 40 crore on account of lesser consumption of diesel, fuel and about Rs.5 crore on account of lesser use of herbicides. Conservation tillage helped in reducing the fossil fuel usage and improved the soil structure and its fertility status. In totality Zero tillage technology has contributed in checking the degradation of natural resources of the state i.e. land and water. (Department of Agriculture, Govt. of Punjab, 2001). These results also agree with the results obtained by Iqbal *et al.*, (2002) where zero-tillage adopters in Wheat after Rice in *kharif* earn an extra income of 633 and 5695 rupees per hectare of wheat over that earned from wheat sown with *rauni* and *wadwattar* methods respectively.

Regression analyses were done to know the contribution of various factors towards net returns of maize cultivated under various tillage methods. A

close examination of the Table 2 revealed that co-efficient of determination ( $R^2$ ) was 0.46 to 0.57 indicating that forty six per cent to fifty seven percent of the variation in gross returns of the crop was explained by the selected variables. It could be understood from the earlier research that factors such as village community meetings, farmer fairs and family size influence technology decision differently. This could be due to the presence of unobserved sample specific effects in the data that are significant but inestimable (<http://users.monash.edu.au/~mishra>, <http://www.igidr.ac.in/~vinod>).

The co-efficient of nursery raising, transplanting, fertilizer, harvesting & post harvesting, manual labour and agricultural chemicals (fertilizers, pesticides and weedicides) were negative and non significant and the co-efficient of fertilizer was positive and non significant. The contribution of expenditure on nursery raising towards net returns were negative and non significant indicating the importance of zero tillage practices in maize. Negative and non significant contribution of plant protection chemicals reflects their irrational use in the study area. Explanatory variable 'Seed' was positive and significant. This might imply the superiority of private hybrids in case of maize and of HYV released by the agricultural university adopted by the paddy farmers of the study area. This was in contradiction with the results obtained by the Rajendra Prasad and Goverdhan (2009) where in 'seed' contribution was negative and significant towards the gross returns of maize in place of *rabi* rice in Nagarjunasagar left canal command area. However, zero tillage practices as a technology was resulted in increase of net returns ranging from Rs. 9553 to Rs.16725 per hectare significant at 5 to 10 per cent level of significance in the analyses. This could be compared with the results of Rice zone of Punjab in Pakistan where the zero-tillage technology in Wheat after Rice enhanced water and fertilizer use efficiency (Iqbal *et al.*, 2002). The importance of mechanization in harvesting and post harvesting of maize could be concluded from the negative and non significant/significant coefficients of 'harvesting, processing and threshing' and also of the coefficient of machine labour towards the net returns of the study area.

### Conclusion

- The expenditure on fertilizers and plant protection chemicals (44.87%) accounted for the highest share in total operational costs per hectare of Maize under zero tillage technology followed by

Table 1. Economics of maize under zero tillage vis-a-vis conventional method of *rabi* rice cultivation (Rs ha<sup>-1</sup>)

Item	Maize under zero tillage (Rs ha <sup>-1</sup> )	Per Cent	Conventional <i>rabi</i> rice (Rs ha <sup>-1</sup> )	Per Cent
Land Preparation	0	0.00	5035	22.78
Sowing	2092	14.91	2817	12.75
Fertilisers	4397	31.35	4035	18.26
Plant protection chemicals	1897	13.52	3535	15.99
Weeding	965	6.88	1635	7.40
Seed	1895	13.51	1085	4.91
Harvesting	2488	17.74	3535	15.99
Total	13733	97.90	21674	98.07
Interest on working capital	229	1.63	361	1.63
Land revenue	65	0.46	65	0.29
Total operational costs	14027	100.00	22100	100.00
Gross returns	60887	-	59152	-
Net Returns	46860	-	37052	-
Benefit Cost Ratio	3.34	-	1.68	-

Table 2. Linear estimates of factors affecting the gross returns of maize.

Explanatory variables	Regression co-efficient	t value	Regression co-efficient	t value	Regression co-efficient	t value
Nursery raising	-	-	-29.73	0.604	-	-
Seed cost	39.47**	2.455	93.79**	3.325	94.91**	3.40
Transplanting	-	-	-25.50	1.010	-28.93	1.19
Technology	16724.74*	2.076	9553.26**	2.818	13972.71**	2.76
Fertiliser	-	-	-41.17	1.110	-	-
Weeding	-	-	1.69	0.430	1.72	0.44
Harvesting, Processing & Threshing	-	-	-22.45	0.452	-49.12**	2.20
Machine labour	-55.80**	2.210	-	-	-18.55	1.03
Agricultural chemicals	-1.72	0.439	-	-	-	-
Manual labour	-0.40	0.114	-	-	0.57	-
R <sup>2</sup>	0.47	-	0.57	-	0.49	-
Adj. R <sup>2</sup>	0.39	-	0.48	-	7.13	-
F Value	6.04	-	6.05	-	40.00	-
N	40.00	-	40.00	-	33.00	-
d.f	34.00	-	32.00	-	2.16	-
t tab (0.05)	2.19	-	2.12	-	-	-
Dependent Variable	Net returns		Net returns		Net returns	

\*\* Significant at 5 per cent level of probability

\* Significant at 10 per cent level of probability

harvesting (17.74%), sowing (14.91%), seeds (13.51%), and weeding (6.88 %).

- Zero tillage technology saves on an average Rs.5035 required for land preparation when compared to conventional *rabi* rice cultivation.
- The contribution of expenditure on nursery raising towards net returns were negative and non significant indicating the importance of zero tillage practices in maize.
- Negative and non significant contribution of agricultural chemicals reflects their irrational use in the study area.
- Explanatory variable 'Seed' was positive and significant indicating the superiority of private hybrids in case of maize and of HYV released by the agricultural university by the paddy farmers of the study area..
- Zero tillage practices as a technology in Maize was resulted in significant increase of net returns ranging from Rs. 9553 to Rs.16725 per hectare in the study area.

#### Suggestions

- Standardization of package of practices for Maize under zero tillage which includes integrated crop management practices (INM and IPM) and their dissemination would

ensure optimum utilization of fertilizers and pesticides. This would increase the returns of farmers cultivating Maize crop in the village.

- Zero tillage practices in particular and farm mechanization in general should be encouraged in maize crop to improve the returns to the farmers.

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