

Economic Analysis of Zero Tillage Technology in Maize

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Farmers of Neelaigudem village in Tripuraram mandal in Nalgonda district like all other farmers of NSP left canal command area are habituated to Rice-Rice Monoculture. In recent years they are facing the problem of late release of canal water in Kharif, consequent outbreak of pest and diseases, advancement of Rabi towards summer, with enhanced load of pest and diseases ultimately resulting in drastic yield reduction. The preponderance of low minimum support price has put a question mark on Rabi rice cultivation in the area. At last, they came across maize crop introduced by the Agricultural Research Station, Kampasagar under the ATMA project assisted by the State Department of Agriculture. They have been given seeds, weedicide and fertilizers on 100 per cent subsidy from ATMA and the research station was instrumental in introducing zero tillage machines for sowing operation immediately after harvesting of kharif paddy without going for hefty land preparation for sowing. A tractor drawn zero till drum to meet the farmers demand in the surrounding area of the Research Station to grow maize under zero till drill conditions was also introduced. Zero till drum enables making of holes in the unprepared harvested rice field thus facilitating women labour for proper seed placement. Further, zero till drill machine is seed-cum-ferti type. In the first crop season (2006-07), only two farmers came forward to grow maize in Rabi after rice under zero tillage method. In the subsequent year, the farmers have realized the advantage of growing maize under zero tillage condition, which resulted in cultivation of 200 acres of maize in the village which is commendable. The main advantage of the technology is saving of the cost of Rs. 2500/- per acre towards land preparation. The crop season is advanced by at least 20 days to avoid coincidence of peak summer at harvesting phase.

The present study was undertaken to evaluate the zero tillage method of maize cultivation in Neelaigudem village of Tripuraram mandal of Nalgonda district in Andhra Pradesh with the following objectives:

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

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

Methodology

Neelaigudem village of Tripuraram mandal in Nalgonda 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 advocated by the Agricultural Research Station (ARS), Kampasagar of Acharya N.G.Ranga Agricultural University. The ARS, Kampasagar has introduced Maize crop in lieu of Rabi rice in Nagarjunasagar Left Canal Command (NSP) area in Rice – Rice cropping system in collaboration with Agricultural Technology Management Agency (ATMA), Department of Agriculture, Government of Andhra Pradesh. The data on expenditure incurred towards land preparation, sowing, manures and fertilizers, herbicides, hand weeding, seeds, harvesting and threshing and other expenditure incurred in the production process during the agricultural year 2007-08 were collected from 30 farmers who have cultivated maize under different tillage methods. 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 data were analyzed using SPSS Statistical package. In order to understand the factors affecting the gross returns of maize, a linear regression model in the form of following equation was fitted.

$$Y = f (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9)$$

Where, Y is the gross returns on Maize, expenditure incurred on land preparation, sowing, fertilizers and plant protection chemicals, herbicides, hand weeding, seeds, harvesting and threshing expressed in terms of rupees, are $X_1, X_2, X_3, X_4, X_5, X_6, X_7$ and X_8 respectively. X_9 is the dummy for tillage methods i.e., Zero tillage = 1, otherwise = 0. Maize sown by Zero Till Drill Machine, Hand dibbling and Zero till drum was considered as zero tillage technology. The dummy was supposed to evaluate the contribution of the tillage methods towards the gross returns of Maize.

Results and Discussion

The results of costs and returns analysis are presented in Table 1. A perusal of the table reveals that the total operational cost per hectare of maize under zero tillage was Rs. 12311. The expenditure on fertilizers and plant protection chemicals (25.68 per cent) accounted for the highest share in total operational costs per hectare of Maize under zero tillage technology followed by threshing (19.41 per cent), Seeds (18.53 per cent), Sowing (14.22 per cent) and Herbicides (10.67 per cent). The gross returns and net

returns per hectare were Rs. 38919 and Rs. 26608 respectively. Comparable results were obtained in the experiment conducted at Mahabubnagar where a yield of almost 15 quintals per acre of maize resulted by adopting zero tillage method (The Hindu 2007). The cost benefit ratio worked out to be Rs. 2.16 which indicated that the Maize crop under zero tillage in Rabi ensures at least Rs. 3.16 on every rupee invested. Further, it saves on an average Rs. 3216 required for land preparation when compared to the conventional method of Maize cultivation. The results are in coincidence with the result of adoption of Zero Tillage Technology in Punjab state where farmers have saved almost Rs. 40 crores on account of lesser consumption of diesel, fuel and about Rs.5 crores on account of lesser use of herbicides. Retention of residues has helped in improving the soil microclimate, minimizing the pollution due to burning of paddy straw thereby improving 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 those obtained by Iqbal et al (2002) where zero-tillage adopters in Wheat after Rice in Kharif earn an extra income of 253 and 2278 rupees per acre of wheat over that earned from wheat sown with rauni and wadwattar methods respectively.

Table 1. Comparative Analysis of Costs and Returns of zero tillage vis –a – vis Conventional method of Maize cultivation (Rs/ha)

Item	Zero tillage Maize	Per Cent	Conventional Maize	Per Cent
1. Land Preparation	--	--	3216	21.74
2. Sowing	1751	14.22	1238	8.37
3. Fertilizer and Plant Protection chemicals	3161	25.68	3475	23.49
4. Herbicides	1314	10.67	--	--
5. Hand weeding	--	--	675	4.56
6. Seed	2281	18.53	2262	15.29
7. Harvesting	1161	9.43	1250	8.45
8. Threshing	2390	19.41	2388	16.14
9. Total	12058	97.94	14504	98.03
10. Interest on working capital	188	1.53	227	1.53
11. Land revenue	65	0.53	65	0.44
12. Total operational costs	12311	100.00	14796	100.00
13. Gross returns	38919		39026	
14. Net Returns	26608		24230	
15. Benefit Cost Ratio	2.16		1.64	

Regression analysis was carried out to understand the contribution of various factors towards gross returns of maize cultivated under various tillage methods. A close examination of Table 2 reveals that Co-efficient of determination (R^2) was 0.46 indicating that forty six per cent 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 also 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>).

Table 2. Linear estimates of Factors affecting the Gross Returns of Maize

Explanatory variables	Regression Coefficient	't' Value
1 .Land Preparation	8.40	1.58
2. Sowing	-10.41	1.60
3. Fertilizers and Plant protection chemicals	-23.53	1.65
4. Herbicides	95.03	2.40**
5. Hand weeding	15.55	0.87
6. Seeds	-47.17	2.73**
7. Manual labour	12.00	0.59
8. Machine labour	17.43	0.70
9. Dummy for tillage methods	9517.99	1.18

** Significant at 5 per cent level of probability

Note : R^2 : 0.46

Adj. R^2 : 0.42

n : 30

The co-efficient of land preparation, manual weeding, manual labour and machine labour were positive and non significant. The positive and significant contribution of chemical weeding was in agreement with the results of weed survey comparing zero and conventional tillage systems in Manitoba where certain annual weeds had lower densities in zero tillage fields (Gordon Thomas et al 1994). There is no substance to describe about variables whose t-values are not significant. However, zero tillage practices as a technology resulted in increase of gross returns to the tune of Rs. 9518 although non-significant. 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).

Conclusion

- * The expenditure on fertilizers and plant protection chemicals (24.68%) accounted for the highest share in total operational costs per hectare of Maize under zero tillage technology followed by threshing (19.41%), Seeds (18.53%), Sowing (14.22%) and Herbicides (10.67%).
- * The cost benefit ratio worked out to be Rs.2.16 which indicated that the Maize crop under zero tillage in Rabi ensures at least Rs.3.16 on every rupee invested.
- * Zero tillage technology saves on an average Rs.3216 required for land preparation when compared to the conventional method of Maize cultivation.
- * Net contribution of expenditure on Land preparation and sowing, towards gross returns were negative and non significant indicating the importance of zero tillage practices in particular and farm mechanization in general.
- * Zero tillage practices as a technology in Maize resulted in increase of gross returns to the tune of Rs. 9518 although non-significant.

Suggestions

- 1 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.
- 2 Zero tillage practices in particular and Farm mechanization in general should be encouraged in Maize crop to improve the returns to the farmers.
- 3 There is an urgent need for lateral spread of this technology for enhancing economic and ecological sustainability. Greater emphasis should be laid for demonstrating the above technology through Frontline Demonstration under ISOPAM for fostering faster spread of the technology.

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