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A CASE STUDY

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Impact of on farm testing on low yield of potato due to frost in Bharatpur district of eastern Rajasthan

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ABSTRACT : The Present study was carried out at Bharatpur district of Eastern Rajasthan during 2012-13, 2013-14 and 2014-15. Potato is one of the most important vegetable crops of the country. The development of the agriculture is primarily depends on the application of the scientific technologies by making the best use of available resources. One of the major constraints of traditional potato farming is low productivity because of non-adoption of advanced technologies to protect the crop from frost. To increase the production, productivity and quality of agricultural produce, on farm testing are being conducted at various farmer's field. All the recommended practices were provided to the selected farmers. The data related to the cost of cultivation, production, productivity, gross return and net return were collected as per schedule and analyzed. Result of the present study revealed that the application of concentrated H_2SO_4 @ 1.0 ml/l water on standing crop recorded the higher yield (307.0 q/ha) as compared to application of thio-urea @ 0.1 per cent on standing crop (294.50 q/ha) and control (265.06 q/ha). The percentage increase in the yield over control 15.82 was recorded.The technology gap in terms of productivity(43.00 q/ha.) were computed. The technology index values 12.28 per cent was recorded.The result of the study indicated the gap existed in the potential yield and demonstration yield is due to soil fertility and weather conditions. By conducting on farm testing of proven technologies of saving the crop by low temperature, yield potential of potato can be increased upto great extent. This will substantially increase the income as well as the livelihood of the farming community.

KEY WORDS : On farm testing, Control, Potato, Technology, Yield

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Generally in Bharatpur district in the month of January there is chance of frost (Low temperature). Being a solanaceous crop potato is severely affected by this. Farmers get low yield of poor quality and result in great monitory loss. To solve the problem of low temperature during crop growth, On farm testing are being conducted at farmers field. OFT's use of thio-urea and concentrated H_2SO_4 with other recommended package of practicces was tried at various selected farmers field.

Potato (*Solanum tuberosum* L.) is basically a crop of the temperate region. However,through the process of breeding and selection, potato has acclimatized to most regions of the world. It is first ranked vegetable crop of the world in area and production and is a stable food of almost half of the world's population. It is one of the four major food crops of the world and ranks fourth after rice,wheat and maize. In total production India ranks second after China. Potato is grown in almost all the states in India except Kerala. However, Bihar, Uttar

Pradesh and West Bengal account for nearly 75 per cent of the total area and 80 per cent of the total production (Dhaliwal,2014). In India, potato had 1.99 million ha. area with the production of 45.34 million tonnes and productivity 22784 kg/ha during 2012-13 (Anonymous, 2014). Potato is also an important source of minerals like calcium, potassium, phosphorus, magnesium, iron and vitamins like B_1, B_2, B_6 and C. Potato, though is poor in protein content (2 %), it is an important source of essential amino acids like lysine, methionine, cysteine, phenylalanine, tryptophan etc. It has 18 per cent starch.It is an integral part of every vegetables culinary preparation. It is being used as boiled, fried, baked, mashed, stewed and roasted. The important processed products include papad, chips flakes, French fries, flour, starch etc. It is also used on a small scale for production of starch, alcohol (Vodka) and ethyl alcohol (ethanol) to be mixed with petrol and as livestock feed (Swarup, 2006).

A field trial was carried out at the farmer's field at Bharatpur District of Rajasthan.It comes in Agro-climatic Zone of Rajasthan III B flood prone Eastern Plain. Here, generally in winters minimum temperature goes to 2-3^o C and in summer maximum temperature reaches to 48^{o}C. Annual rainfall is 664 mm per year. There is lot of scope of potato growing in winter season under assured irrigation facility. In this region low temperature less than 4 ^{o}C (frost) occurs frequently and crop is affected adversally. Hence, in OFT application of concentrated H_2SO_4 and bio-regulator thio-urea was demonstrated on farmers field to protect the potato crop from low temperature.

The main objective of on farm testing (OFT) is to introduce suitable agriculture practices like high yielding varieties, seed treatment, spacing, nutrient management, pest and disease management etc. among the farmers accompanied with organizing extension programmes (field day) for horizontal dissemination of the technologies. OFT is playing a very important role for transfer of technologies and changing scientific treatment of the farmers by seeing and believing principle. In order to have better impact of the demonstrated technologies for farmers and field level extension functionaries, on farm testing (OFT) was conducted for three years on farmers field.

Generally, the agricultural technology is not accepted by the farmers as such in all respects. There is always gap between the recommended technology by the scientist and its modified form at the farmer's level which is major absentee in the efforts of increasing agricultural production in the country. It is need of the hour to reduce this technological gap between the agricultural technology recommended by the scientists or researchers and its acceptance by the farmers on their field. In view of the above facts, on farm testing were undertaken in a systematic manner on farmer's field to show the worth of a new technology and convince the farmers to adopt in their farming system in this region

RESEARCH METHODS

The present study was conducted in Bharatpur district of eastern Rajasthan during 2012-13, 2013-14 and 2014-15. Potato variety Kufri Bahar was sown by the farmers. All the participating farmers were trained on various aspects of potato production technologies. The field was prepared by deep ploughing and harrowing after *Kharif* crops. The seeds (tubers) were sown in well prepared field during last week of October to first week of November. All the recommended practices *i.e.* seed treatment by fungicide, spacing, recommended dose of manure and fertilizers, weed management, insect pest management were provided to the farmers. The data related to cost of cultivation, production, productivity, total return and net return were collected in all treatments as per schedule from all selected farmers. An average of cost of cultivation, yield, net returns of different farmers was analyzed by the formula.

$$\text{Average} = \frac{[F_1 + F_2 + F_3 + \ldots\ldots\ldots\ldots\ldots\ldots Fn]}{N}$$

F_1 = Farmer

N = Number of farmers

In the present study, technology index was operationally defined as the technical feasibility obtained due to implementation of on farm testing in potato. To estimate the technology gap, extension gap and technology index formula used by Samui *et al.* (2000) was used.

Technology gap = Pi (Potential Yield) – Di (Demonstration Yield)

Extension gap = Di (Demonstration Yield) – Fi (Farmers yield)

$$\text{Technology index} = \frac{\text{(Potential yield - Demonstration yield) x 100]}}{\text{Potential yield}}$$

RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Performance of OFT :

A comparison of productivity levels between demonstrated technology to protect the crop from low temperature and control treatment is shown in Table 1. Thio-urea (Thiocarbamide) is an organic compound. It's molecular formula is $Cs(NH_2)_2$, a sulphydryl(-SH-) compound improve phloem translocation of photosynthates and crop productivity.

During the period of study, it was recorded that on farm testing, application of thio-urea @ 0.1 per cent on standing crop recorded the highest yield (307.00q/ha) than application of concentrated H_2SO_4 @ 1.0 ml/l water on standing crop (294.50) and control practice (265.06 q/ha).

The percentage increase in the yield (15.82) over control practice was recorded. Similarly, Yield enhancement in different crops in front line demonstration had apply been documented by Hiremath *et al.* (2007); Mishra *et al.* (2009); Kumar *et al.* (2010); Suryawanshi and Prakash (1993) and Dhaka *et al.* (2010). From these results it is evident that the performance of improved technology application of thio-urea @ 0.1 per cent on standing crop to protect the crop from low temperature adverse effect was found to be better than the application of concentrated H_2SO_4 @ 1.0 ml/l water on standing crop and control practice under same environment conditions.. The farmers were motivated by seeing the results in term of productivity and they are adopting the technologies. The yield of the on farm testing and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology index.

Technology gap :

The technology gap shows the difference between potential yields over demonstration yield of the technology. The potential yield of the variety Kufri Bahar is 350.00 q/ha (Singh, 2013). The technology gap 43.00 q/ha was recorded. The on farm testing was laid down under the supervision of KVK specialist at the farmers field, there exist a gap between the potential yield and demonstration yield. This may be due to the soil fertitlity and weather condition. Hence, location specific recommendations are necessary to bridge the gap. These findings are similar to the finding of Sharma and Sharma (2004) in oil seeds at Baran district of Rajasthan.

Technology index :

Technology index shows the feasibility of the technology at the farmer's field. The lower the value of technology index, more is the feasibility of the particular technology. The result of study depicted in Table 1 revealed that the technology index value was 12.28. It means the technology application of thio-urea @ 0.1 per cent on standing crop to protect the crop from low temperature is suitable for Bharatpur district of Eastern Rajasthan. The result of the present study are in consonance with the findings of Singh *et al.* (1997) and Hiremath and Nagaraju (2009) in onion. Sahu *et al.* (1993) reported that foliar spray of thiourea (TU) significantly

Table 1 : Yield, technology gap and technology index of demonstration

Variables	Yield (q/ha)	Increase (%) over	Technology gap (q/ha)	Technology index (%)
T_1 - Control	265.06			
T_2 - Application of concentrated H_2SO_4 @ 1.0 ml/l water on standing crop application of concentrated H_2SO_4 @ 1.0 ml/l water on standing crop	294.50	11.10	55.50	15.85
T_3 - Application of Thio-Urea @ 0.1% on standing crop	307.00	15.82	43.00	12.28

Table 2 : Economics of on farm testing

Variables	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha.)	Benefit :cost ratio
T_1 -Control	88333.33	190866.66	102533.33	2.16
T_2 - Application of concentrated H_2SO_4 @ 1.0 ml/l water on standing crop	92541.66	211854.00	119312.00	2.28
T_3 - Application of Thio-Urea @ 0.1% on standing crop	93104	220375.00	127271	2.36
Additional in T_3 treatment application	4770.67	29509.00	24737.67	6.18

* incremental benefit :cost ratio.

increased growth and yield of maize,most probably via improvement of the photosynthetic efficiency and canopy photosynthesis. Sahu and Solanki (1991) repoted that sulfhydryl compounds play a role in improving dry matter partitioning for grain production in maize and perhaps of similar other cereals, is of considerable significance for improving crop productivity. Burman *et al*. (2004) revealed synergistic effects of phosphorus and thio-urea in enhancing net photosynthesis,leaf area,chlorophyll content and nitrogen metabolism leading to significant improvement in plant growth and seed yield under water stress condition.

Garg *et al.* (2006) reported that thio-urea as foliar spray significantly increased plant height, leaf area, dry matter production and seed yield as compared to the untreated controls. Thio-urea significantly increased the net photosynthetic rates and the concentration of total chlorophyll and starch in the leaves.Thio-urea also reflected a positive role in enhancing nitrogen metabolism as it significantly increased nitrate reductase activity and concentration of solubility of soluble protein in the treated plants. They concluded that seed treatment with thio-urea followed by foliar spray could significantly improve growth, yield and water use efficiency of rainfed clusterbean under arid conditions due to enhanced photosynthesis and more efficient nitrogen metabolism.

Economics of on farm testing :

Economics of potato production under on farm testing was recorded and the results of the study have been presented in Table 2. The results of economic analysis of potato production revealed that application of thio-urea @ 0.1 per cent on standing crop recorded higher gross return (220375.00 Rs./ha) and net return. (127271 Rs.) with higher benefit cost ratio (2.36) as compared to application of concentrated H_2SO_4 @ 1.0 ml/l water on standing crop and control. These results are in accordanc with findings of Sahu and Singh (1995); Sahu and Solanki (1991); Burman *et al.* (2004); Hiremath *et al*. (2007) and Hiremath and Nagaraju (2009), further, additional cost of Rs. 4770.67 per ha in demonstration has increased additional net return Rs. 24737.67 per ha.with incremental benefit cost ratio 6.18 suggesting its higher profitability and economic viability of the demonstration. More and less similiar results were also reported by Garg *et al.* (2006); Hiremath and Nagaraju (2009) and Dhaka *et al.* (2010).

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