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Impact of ICM technologies on adoption of improved practices of pomegranate (*Punica granatum* L.)

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Abstract
The technological gap between existing and recommended technologies of pomegranate crop was studied during 2015-16 and 2016-17. The study in total 10 integrated crop management (ICM) demonstrations was conducted on farmers' fields. The findings of the study revealed that improved technology recorded a mean yield of 11.0 t/ha which was 18.3 per cent higher than obtained with farmers' practice (18.3 t/ha). The study exhibited mean extension gap of 1.7 t/ha, technology gap of 1.0 t/ha with mean technology index of 8.3 per cent. An additional investment coupled with recommended nutrient, water management, plant protection measures, scientific monitory and non-monetary factors resulted in additional mean returns of Rs.129700/ha. Higher mean net income of Rs. 496000/ha with a BC ratio of 2 .84 was obtained with improved technologies in comparison to farmers' practices (Rs. 366300/ha). The ICM demonstrations conducted on pomegranate at the farmers' field revealed that the adoption of improved technologies significantly increased the fruit yield and also the net returns to the farmers.

Keywords: Pomegranate, ICM, technology, production

Introduction
Pomegranate (*Punica granatum* L.) is one of the ancient and highly praised favorite fruit of Mediterranean, tropical and subtropical regions of the world. It is an important commercial fruit preferred by the consumer all over the world for its sweet- acidic taste, fine dessert quality and excellent blend. Pomegranate is widely considered native to the region from Iran to Northern India (Morton, 1987). The fruit is commercially cultivated in the Mediterranean region and in countries like Spain, Morocco, Egypt, Pakistan (Baluchistan), Afghanistan, Iraq, Iran, China, Japan, Russia and India. Of late, this crop is gaining popularity in arid and semi-arid regions of India due to its wide adaptability, higher yield, drought hardiness and tolerance to salinity. In terms of farmer's economy, pomegranate is next to grape in its importance and is cultivated in various districts of Maharashtra, commercially (Kaulgud, 2002) [5]. In India, it attained commercial status only after 1985-86 and now its cultivation is done on scientific lines particularly in states like Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Tamil Nadu, Rajasthan and to some extent in Himachal Pradesh. India is the world's leading producer of pomegranate with nearly 50 per cent of world's production. The total area under this fruit at present accounts to 113.2 thousand hectare with an annual production of 745 thousand metric ton of which 78 thousand hectare area and 408 thousand metric ton production is met by Maharashtra (Anon., 2013) [1].

Unlike arid subtropical regions of the country, pomegranate growing in Himachal Pradesh, experiences different kind of climate, as it enters into dormancy during winters. On the other hand; prolonged rains during July and August results in high incidence of fungal disease. Therefore, orchard management practices under Himachal Pradesh conditions particularly pruning and orchard floor management need to be standardized keeping in view varied agro climatic conditions. Orchard management practices, which includes orchard floor management and canopy management are the most important cultural practices for successful and sustainable cultivation of any fruit crop including pomegranate. Orchard management systems have an effect on growth, yield and fruit quality through their smoothening effects on the availability of nutrients, conservation of moisture and reduction of weed competition. Pruning of fruit trees is very important aspect for the improvement of fruit quality and to minimize the pests and disease attack. Rejuvenation of fruit trees is an important operation in invigorating declining fruit trees, where the yield is substantially low due completion of productive life or increased incidence of disease and pest. Rejuvenation treatments help in earlier fruiting as compared to replant orchards at same site.

The conventional method of hand weeding is most expensive, laborious and injures the feeding roots. The trend a now days has shifted to integrated use of mulches and herbicides for the conservation of moisture and control of weed flora. Conservation of soil moisture and maintenance of fertility are essential to regulate the sustained nutrient supply to fruit plants. Orchard canopy and floor management practices help in better light interception, regulation of soil erosion, reduced surface run-off and suppress weed population.

The extent of adoption of improved agricultural technologies is a crucial aspect under innovation diffusion process and the most important for enhancing agricultural production at a faster rate. Large number of technologies evolved in the field of agriculture is not being accepted and adopted to its fullest extent by the farmers. The gap between recommendations made by the scientists and actual use by farmers is frequently encountered. Looking into the situation AEEC, Lingsugur has conducted integrated crop management (ICM) practices through large scale demonstrations.

Materials and Methods

The ICM demonstrations were conducted at AEEC, Lingsugur in Raichur district in Karnataka state in farmers fields during 2015-16 and 2016-17 with objective to popularize improved technologies for productivity enhancement of pomegranate through demonstrations. Ten ICM demonstrations were conducted in farmer's field. To diffuse pomegranate productivity enhancement technologies on campus and off campus trainings were conducted. Then improved practices were demonstrated with the following technologies

1. Improved variety- Kesar
2. Application of biofertilisers (PSB) and biopesticides (Trichoderma, *Pseudomonas fluorescence*)
3. Balanced nutrient application (FYM 12.5 t/ha, 197 kg N, 99 kg P_2O_5, 99 kg K_2O)
4. Integrated pest and disease management(Timely spray of pesticides)

The crop was harvested at maturity stage. For the study, technology gap, extension gap and technology index were calculated as suggested by Samui *%*. (2000).

Technology gap= Potential yield – Demonstration yield

Extension gap = Demonstration yield – Farmers yield

Technology index (%) = (Potential yield – Demonstration yield /Potential yield) * 100

Result and Discussion

The data were subjected to analysis, technology gap, extension gap and technology index were calculated as per the formula and economic analysis was done as per procedure and data were presented in the table 1 and 2.

The average fruit yield of pomegranate was 11.0 tonnes per ha as against 9.8 in farmers field which is 18.3 per cent higher. The higher yield of pomegranate in demonstration plot was mainly attributed to the adoption of improved technologies. Application of bio-inputs enabled to mobalise nutrients from native soil nutrients and Trichoderma helped the crop to resist against diseases. The technology gap in the demonstration yield over potential yield was 1.0 t per ha. The technological gap may be attributed to the dissimilarity in the soil fertility status and weather conditions (Anuja *%*., 2014) [2]. The extension gap of 1.7 t per ha was noticed. This emphasized the need to educate the farmers through various means for the adoption of improved agricultural technologies to reverse this trend of wide extension gap. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap (Balai *%*., 2012) [3]. The new technologies will eventually lead to the farmers to discontinue the old technology and to adopt new technology. The technology index shows the feasibility of the evolved technology at the farmer's fields and lower value of technology index more is the feasibility of the technology. In this demonstration noticed 8.3 per cent technologies index, which indicates proper adoption of improved technologies. Similar results were also recorded by Keshavareddy *%*. (2018) [6] in mango, Shalini *%*. (2016) [10] in tomato, Renbomo Ngullie and Pijush (2016) [11] in chilli, Vikram *%*. (2018) [13] and Rupesh (2015) [8] in sunflower and Berjesha *%*. (2013) [4] in Brassica.

The inputs and outputs prices of commodities prevailed during the study demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit cost ratio (Table 2). The cultivation of pomegranate with improved technologies gave higher net return of Rs 496000 /ha as compared to farmer's practices (Rs 366700 /ha), which gave additional returns of Rs 129700 /ha. The benefit cost ratio of pomegranate in ICM was 2.84. This is due to attributed higher fruit yields obtained under improved technologies compared to farmers plot as local check.

Table 1: Fruit yield of pomegranate, technology gap, extension gap and technology index as influenced by improved practices

Year	Fruit yield (t/ha)		% increase in yield in ICM over FP	Technology gap (t/ha)	Extension gap (t/ha)	Technology index (%)
	ICM	FP				
2015-16	10.5	8.8	19.3	1.5	1.7	12.50
2016-17	11.5	9.8	17.3	0.5	1.7	4.17
Average	11.0	9.3	18.3	1.0	1.7	8.3

Table 2: Economic analysis of pomegranate demonstration

Sl. No	Net returns (Rs/ha)		Additional returns (Rs /ha)	B:C	
	ICM	FP		ICM	FP
2015-16	285000	171400	113600	3.01	2.16
2016-17	414600	341300	73300	4.07	3.19
Average	349800	256350	93450	3.54	2.68

Conclusion

The study has shown that the ICM demonstration programme was found useful in enhancing the knowledge and adoption level of farmers in various aspects of pomegranate production technologies. ICM practices created great awareness and motivated the other farmers to adopt appropriate pomegranate production technologies. The area of high yielding seedling material of pomegranate has increased which will spread in the taluk including the adjoining area. The selection of critical input and participatory approach in planning and conducting the demonstration definitely help in the transfer of technology to the farmers.

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