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Impact of NAIP Project, "Value Chain on Flowers for Domestic and Export Markets" on Technology Adoption among Jasmine Growers in Erode District

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The project "Value Chain on Flowers for Domestic and Export Markets" funded under National Agricultural Innovation Project, ICAR, New Delhi and was implemented by Tamil Nadu Agricultural University to address all those missing links by intervening in production, post harvest and marketing aspects of jasmine value chain. This paper focuses on the impact of NAIP on technology adoption among jasmine growers. The results revealed that awareness, knowledge and adoption of precision technology and average yield significantly improved after implementation of NAIP.

Key words: Jasmine, Technology adoption, Impact analysis and Precision farming.

In India flowers are an integral part of the religious, cultural and social functions. About 1.6 lakh hectare area was under flower cultivation in 2010-11. Production of flowers was estimated to be 870.4 million tonnes of loose flowers and 43417.5 million (numbers) cut flowers in 2010-11. India exported 27,776.13 tonnes of floriculture products during 2010-11 (www.apeda.gov.in). Growing at a compounded annual growth rate of about 30 per cent, India's floriculture industry was estimated to cross Rs 8,000 crore mark by 2015. Currently, the floriculture industry in India is poised at about Rs 3,700 crore with a share of a meagre 0.61 per cent in the global floriculture industry which is likely to reach 0.89 per cent by 2015. The global floriculture industry is likely to cross Rs 9 lakh crore mark by 2015 from the current level of about Rs 6 lakh crore and is growing at a CAGR of 15 per cent (ASSOCHAM, 2012). Among the loose flowers, jasmine is one of the important crops in Tamil Nadu which contributes around 80 per cent of the India's production.

Jasmine in Tamil Nadu

Tamil Nadu produce 2.01 tonnes (24.22 % of India's share) of loose flowers such as jasmine, chrysanthemum, marigold, rose, crossandra and nerium in an area of 24,750 hectares. The flowers produced in the State were being exported to the countries like, Sri Lanka, Singapore, Malaysia and Middle East countries and of late even to parts of the United States. Erode, Dindigul, Kanyakumari, Ramanathapuram, Coimbatore, Madurai, Salem, Tirunelveli, Virudhunagar and Trichy are the major jasmine producing districts in Tamil Nadu. Tamil Nadu produced 76671 tons of Malligai (*Jasminum sambac*), 27158 tonnes of Mullai (*J. auriculatum*) and 7641 tonnes of Jathi Mullai (*J. grandifloram*) from 9893 hectares, 3195 hectares and 849 hectares respectively in 2005-06.(TN State Dept. of Horticulture Report, 2006).

Challenges in the floriculture sector

In spite of the fast growth of India's floriculture sector, its share in the global floriculture trade is very minimum. Even though Tamil Nadu contributes significantly in India's jasmine production, Tamil Nadu farmers have been cultivating local varieties of jasmine which leads to low productivity. To address this issues Tamil Nadu Agricultural University (TNAU), implemented a project entitled 'Value chain on flowers for domestic and export markets' funded under NAIP. The project was implemented during September 2008 to June 2012. Under this project the jasmine growers were trained on different aspects of jasmine production, post harvest and marketing through 12 training programmes and two exposure visits. Keeping these things in mind, the present study was undertaken to analyze the impact of NAIP on awareness, knowledge and adoption of precision technologies among the jasmine growers with the following specific objectives:

i. to assess the impact of NAIP on awareness, knowledge and adoption level of precision farming technologies and consequent yield increase among the jasmine growers

ii. to analyze the factors influencing the adoption of precision production technologies of jasmine

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iii. to analyze the constrain faced by the jasmine growers in adoption of precision production technologies

Materials and Methods

The small and marginal farmers whose major source of income was mainly from jasmine cultivation and those who attended the training programmes conducted through the NAIP formed the population for this study. From the population, 50 farmers were selected by simple random sampling method. The primary data was collected from selected sample farmers through pre tested interview schedule by personal interview method. Proper cross checking measures was undertaken to eliminate the recall bias among the sample farmers. The impact was analyzed before and after NAIP implementation basis (Salehin et al., 2009). The awareness, knowledge and adoption index (Sharma et al., 2002) of precision technologies were estimated based on the farmers responses on three point continuum namely, high, medium, no awareness, high, medium, low knowledge and full, partial and no adoption with numerical score of 3, 2 and 1, respectively. The awareness, knowledge and adoption index were calculated by dividing the average score for a given practice with its maximum obtainable score multiplied by hundred.

The “t” test (Salehin et al., 2009) was employed to find out if there was any significant difference in awareness, knowledge and adoption of precision technologies before and after implementation of NAIP. Multinomial logit model (Jariko et al., 2011) was estimated using STATA software to indentify the factors influencing the adoption of precision technologies among jasmine growers. Technology adoption was considered as dependent variable and age, education, experience, size of landholding, income, number of trainings participated, level of commodity group participation, level of awareness, availability of labour, availability of technology and availability of credit as independent variables. Rank Based Quotient (RBQ) was used to rank the constraints in the adoption of precision technologies by jasmine growers.

Results and Discussion

Majority of the sample farmers (52 per cent) belonged to the age group of 31 to 40 years educated (76 per cent) and had farming experience of more than 11 to 15 years (42 per cent). It could be concluded that most of the sample farmers were middle aged, educated and well experienced in jasmine farming.

Awareness index

Awareness indicates the familiarity and popularity of the technology among the farmers. According to Supe (1994) awareness constituted the first stage of innovation decision process where in the individual was exposed to an idea but lacked detailed information about it. Awareness index of the farmers on precision production technologies of jasmine are presented in Table 1.

From the Table 1, it could be observed that, the percentage change in awareness on use of bio-control agents after implementation of NAIP was 81.46 per cent followed by pre cooling method (61.72 per cent) and use of growth promoters (49.01 per cent). Because the sample farmers were participated training progrmmes regularly, through which they gained good awareness on these precision technologies. The change in awareness level was low in case of use of bio-fertilizer, drip and fertigation and pruning because the farmers had considerable awareness of these technologies before implementation of NAIP as awareness on these technologies were given by State department of agriculture. T-test results revealed that, there is significant difference between the awareness level of precision production technologies among the jasmine growers before and after implementation of NAIP. So it could be inferred that awareness index of different precision production technologies have been tremendously improved after implementation of NAIP.

Table 1. Awareness index

Technology	Before NAIP	After NAIP	Change %
Use of bio-control agents	47.09	85.45	81.46
Pre cooling	54.61	88.32	61.72
Use of growth promoters	62.24	92.75	49.01
Plant protection technologies	59.98	89.00	48.38
Soil and water analysis	67.59	95.89	41.87
Use of bio-fertilizers	76.56	98.23	28.30
Drip and fertigation	78.90	98.98	25.44
Pruning	85.12	97.37	14.39

(Calculated t value 6.1754, Table t value 1.894579)

Knowledge index

Knowledge of farmers in different aspects of farm operation plays a major role in successful technology adoption at the field level. Hence the knowledge level of farmers were analyzed and presented in Table 2.

Table 2. Knowledge index

Organization	Before NAIP	After NAIP	Change (%)
Use of bio-fertilizer	41.33	76.00	83.87
Use of growth promoters	43.33	78.67	81.54
Soil and water analysis	51.33	86.00	67.53
Use of bio-control agents	40.67	66.00	62.30
Pre cooling	42.00	65.33	55.56
Drip and fertigation	58.67	83.33	42.05
Plant protection technologies	55.68	76.67	37.69
Pruning	74.67	96.00	28.57

(Calculated t value 3.7863, Table t value 2.1318)

From the Table 2 it could be observed that, the percentage change in knowledge level on bio fertilizer usage was 83.87 per cent followed by knowledge on use of growth promoters (81.54 per cent) and knowledge on soil and water analysis (67.54 per cent). The pamphlets, leaflets and crop guides distributed during training programmes have considerably contributed to the improvement of knowledge of farmers. The change in knowledge level of pruning and plant protection technologies was low because, the farmers had enough knowledge on these technologies before implementation of NAIP. T-test revealed that, there is significant difference between the knowledge level of farmers before and after implementation of NAIP. It could be inferred that, knowledge level of sample farmers in the project area has been significantly improved after implementation of NAIP.

Adoption index

Adoption indicates that the given technology was installed and used by the farmers in the field level. Roger and Shoemaker (1971) defined adoption as a decision to make full use of an innovation as the best of action available. The adoption index of the farmers on precision production technologies of jasmine are presented in Table 3.

Table 3. Adoption index

Technology	Before NAIP	After NAIP	Change (%)
Drip and fertigation	35.67	65.67	84.11
Soil and water analysis	46.67	84.67	81.43
Use of growth promoters	41.98	75.37	79.53
Plant protection technologies	42.33	72.00	70.09
Use of bio-fertilizers	46.00	70.00	52.17
Pruning	72.67	94.00	29.36
Pre cooling	37.33	48.00	28.57
Use of bio-control agents	36.00	40.00	11.11

(Calculated t value 9.04634, Table t value 1.894579)

From the Table 3, it could be observed that, the percentage change in adoption of precision technologies such as drip and fertigation was 84.11 per cent followed by soil and water sample analysis (81.43 per cent) and use of growth promoters (79.53 per cent). The exposure visits and on farm demonstration of precision technologies, improved the confidence level of farmers and leads to the adoption of these technologies among the sample farmers. The finding is in accordance with the finding reported by Sharma (2002) that, the adoption index (83.46) of improved technologies among trained farmers was higher than the adoption index (42.66) of non-trained farmers. The use of bio-control agents such as *Bacillus subtilis* and *Tricoderma viride* was low among the farmers due to non availability of the products. The t test results revealed that, there is significant difference between the adoption level of precision technologies among jasmine growers before and after implementation of NAIP. So it could be inferred that adoption index of different precision production technologies have been tremendously improved after implementation of NAIP.

Awareness to Adoption ratio

Awareness to adoption ratio of a given technology was calculated by dividing adoption index with awareness index. The results are furnished in the Table 4.

Table 4. Awareness to adoption ratio

Technology	Before NAIP	After NAIP	Change (%)
Drip and fertigation	0.45	0.66	46.76
Soil and water sample analysis	0.69	0.88	27.88
Use of growth promoters	0.67	0.81	20.48
Use of bio-fertilizers	0.60	0.71	18.60
Plant protection technologies	0.71	0.81	14.63
Pruning	0.85	0.97	13.08
Pre cooling	0.68	0.54	-20.50
Use of bio-control agents	0.76	0.47	-38.77

From the Table 4, it could be observed that, after implementation of NAIP, the percentage change in awareness to adoption ratio of jasmine precision technologies such as drip and fertigation was 46.76 per cent followed by soil and water sample analysis (27.88 per cent) and use of growth promoters (20.48 per cent). It could be concluded that, the sample farmers have convinced with these technologies and adopted the technologies in their field. The technologies such as use of bio-control agents (38.77) and pre cooling practices (20.50) have negative change because the adoption have not been significantly increased in relation with awareness level. The adoption of bio-control agents was low because of non availability of the products. So it could be inferred that, apart from these two technologies the awareness to adoption ratio of different precision production technologies have been tremendously improved after implementation of NAIP.

Changes in average yield of jasmine

Yield determines the farm income, intern which influences the choice of technology in jasmine farming in subsequent years. The details on average yield of jasmine are presented in Table 5.

Table 5. Changes in average yield of jasmine

Yield (tons/ha)	Before NAIP	After NAIP
< 7	15 (30 %)	2 (4 %)
7- 9	24 (48 %)	5 (10 %)
9- 11	6 (12 %)	7 (14 %)
11-13	5 (10 %)	23 (46 %)
> 13	-	13 (26 %)
Average Yield	7.14	11.46

It could be explained from the Table 5 that, before NAIP most of the farmers (48 per cent) belonged to the yield category of 7 to 9 tons per hectare followed by less than seven tons per hectare (30 per cent). After NAIP implementation most of the farmers (46 per cent) got the average yield of 11 to 13 tons per hectare followed by more than 13 tons per hectare (26 per cent). The average yield of jasmine was increased from 7.14 to 11.46 tons per hectare. The finding was in accordance with the finding reported by Saka et al. (2005) that, the mean yield of improved rice technology was significantly higher than the yield of the local varieties and Maheswari et al. (2008) that after the adoption of precision production technology the yield of tomato was improved up to

80 per cent and yield of brinjal was increased up to 34 per cent. Hence, it could be concluded that most of the jasmine farmers in the study area have moved from low yield category to higher yield category after implementation of NAIP.

Factors influencing the adoption of precision production technologies

The multinomial logit (MNL) model was used to explain the factors influencing the adoption of precision production technologies of jasmine farming. The estimation of MNL was undertaken by normalizing one category, which is normally referred as “reference state” or “base category”. In this analysis adoption of post harvest management was the base category. The parameter estimates of MNL model is presented in the Table 6. It provide only the direction of effect of the independent variables on the dependent variable; it does not represent actual magnitude of change or probabilities. Thus, the marginal effects from MNL, which measures the expected change in probability of adoption being made with respect to a unit change in an independent variable are reported in Table 7.

Table 6. Parameter estimates of multinomial logit model

Particulars	Soil and water test	Use of bio-fertilizer	Drip and fertigation	Plant protection	pruning
Education	-0.1418	-0.0260	1.7274***	1.0630*	-0.2197
Experience	0.2744	0.2979	0.1475	1.4829*	0.2784*
Size of landholdings	0.2008	0.00017*	-0.00003	0.2879	1.5878**
Income	0.6044**	0.9504***	0.8853***	0.7940	-0.6128
Number of training	1.4238**	0.1252	0.8809*	1.2039**	4.9726*
Commodity group participation	-0.0989	-0.9311	0.0741	-0.1996	0.3052
Awareness level	1.8785***	1.8066***	0.0006*	0.0006	0.8286*
Availability	0.0001	0.4657	-0.0977	0.1369	0.4650

Note: *** 1%, ** 5% and * 10% level of significance

It could be inferred from the Table 7 that, education has significantly and positively influenced the adoption of precision technology. More educated farmers are likely to adopt precision technologies than less educated farmers. A unit increase in educational level would result in a 12.04 and 11.66 per cent increase in probability of using bio-fertilizer and post harvest technologies respectively. More experienced farmers are likely to adopt precision technologies than less experienced. A unit increase in the year of experience would result in a 1.58 and 0.83 per cent increase in probability of adopting proper plant protection and pruning technologies respectively. These results were accordance with the results of Faturoti et al., (2006) that, education and farming experience has positive influence on adoption of banana production technologies.

Table 7. Marginal effect from multinomial logit model

Particulars	Soil and water test	Use of bio-fertilizer	Drip and fertigation	Plant protection	Pruning	Post harvest
Education	-0.0318	0.1204	0.0049	-0.2455	-0.9713	0.1166
	(-1.43)	(1.95)**	(0.76)	(-0.32)	(-0.34)	(1.936)*
Experience	-0.0261	-0.0049	-0.0173	0.0158	0.0083	-0.6188
	(-0.72)	(-0.18)	(-1.00)	(1.61)*	(2.724)***	(-0.95)
Size of landholdings	0.1186	7.26e-06	0.0051	0.0168	0.1358	1.5232
	(2.22)**	(1.18)	(2.377)**	(3.017)***	(1.932)*	(0.47)
Income	0.0417	0.0675	0.0062	-0.0476	-1.2622	0.0003
	(1.33)	(2.61)***	(2.724)***	(-1.52)	(-1.33)	(1.07)
Number of training	0.0280	0.0283	0.0248	0.0861	0.7366	0.0723
	(0.47)	(1.24)	(1.903)*	(2.434)**	(0.10)	(2.248)**
Commodity group	-0.0049	-0.0006	0.0048	0.0007	-0.0280	0.4034
participation	(-0.19)	(-0.03)	(0.77)	(0.04)	(-1.58)	(0.81)
Awareness level	0.1531	0.0280	-0.00001	0.1113	0.2812	0.0231
	(2.78)***	(1.88)*	(-1.15)	(1.81)*	(0.17)	(2.014)**
Availability	-0.0436089	0.0161753	0.0088	-0.3196	0.0847	0.0063
	(-1.59)	9 (0.43)	(2.608)***	(-1.24)	(2.83)***	(0.56)

Note: *** 1%, ** 5% and * 10% level of significance

Size of land holding had significantly and positively influenced the adoption of precision technologies. A unit increase in size of land holding would result in a 11.86, 0.51, 1.68 and 13.58 per cent increase in adoption of soil and water test, drip and fertigation, plant protection and pruning technologies respectively. This result was similar to those obtained by Kitojo (2009) that size of land holding was positively influenced the adoption of fish farming and Jariko et al., (2011) that, farm size positively influenced the adoption of sunflower varieties. A unit increase in income would result in a 6.75 and 0.62 per cent increase in usage of bio-fertilizer and drip and fertigation respectively. The farmer attends more number of training likely to adopt precision technologies than other farmers. A unit increase in number of trainings attended by the farmers would result in a 2.48, 8.61 and 7.23 per cent increase in adoption of drip and fertigation, plant protection and post harvest technologies respectively. Farmers with higher level of awareness would likely to adopt precision technologies than others. A unit increase in awareness level would result in a 15.31, 2.80, 11.13 and 2.31 per cent increase in adoption of soil and water test, usage of bio-fertilizer, plant protection and post harvest technologies respectively. A unit increase in availability of specific inputs results in a 0.88 and 8.47 per cent increase in adoption of drip and fertigation and pruning technologies respectively. These results were in agreement with results obtained by Adeogun et al., (2008) that, availability of specific technologies were positively influenced the adoption of hybrid fish.

Problems in adoption of precision production technologies

Numbers of training programmes and exposure visits were organized by the NAIP to improve the adoption of precision technologies among the jasmine farmers. But all the farmers have not adopted the given technologies. To identify the major problems associated with adoption of precision production technologies in the study area were collected and the results are furnished in Table 8.

Table 8. Problems in adoption of precision production technologies

Problems	Mean score	Rank
High cost of inputs	61.53	I
Non availability specific inputs and technologies	55.23	II
Access to further information	52.19	III
Low volume of credit	48.24	IV
Lack of skilled manpower	43.72	V
Small landholding	38.21	VI

Among the various problems identified, high cost of inputs was the major problem that limits the farmer from adoption of precision production technologies in jasmine cultivation. The non availability of specific inputs such as bio-control agents and bio-fertilizers, access to further information after the completion of training, low volume of credit, lack of skilled manpower and small landholding nature were the important problems in adoption of precision technologies as perceived by the sample farmers in the project area. These results were in accordance with the results obtained by Maheswari et al., (2008) that, small landholding, lack of skilled manpower and non availability of specific technologies was the important constraints in adoption of precision technologies among tomato farmers.

Conclusion

The studies revealed that majority of the sample farmers are educated, belonged to the middle age group and have enough experience in jasmine cultivation. The awareness, knowledge and adoption of precision production technologies have significantly improved after intervention of NAIP. The average yield has improved from 7.14 to 11.46 tons per hectare after implementation of NAIP. Education, size of land holding, awareness level and availability of specific inputs were the important factors which influenced the adoption of precision production technologies among the jasmine farmers. High cost of inputs, non availability of specific inputs and access to further information were the important constraints which affects the adoption of precision production technologies. As like precision technologies of vegetables in Dharmapuri and Krishnagiri area, the NAIP has successfully implemented the precision technologies in jasmine cultivation in Erode district and this model can be replicated in other major jasmine producing areas of Tamil Nadu.

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