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Assessment of knowledge and adoption level of Kinnow growers about the use of drip irrigation system

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Abstract

The study was carried out Kinnow growing farmers in the Sri Ganganagar district of Rajasthan, which is the highest Kinnow producing district in the Rajasthan. The finding revealed that majority of farmers (31.25%) had high knowledge of recommended Kinnow cultivation practices, while 41.25% and 27.5% had medium and low level of knowledge, respectively. Nearly 2/3rd (66.25%) Kinnow growers, using Drip irrigation system had medium level of knowledge followed by 18.75% and 15% high and low level of knowledge respectively. About 30.00% of the respondents had a high degree of adoption, followed by medium (48.75%) and low (21.25%) levels of adoption about drip irrigation system in Kinnow cultivation practice. The economic constraints were major constraints faced by Kinnow growers with the adoption of DIS in Kinnow cultivation followed by maintenance, educational, technical, extension related and climate & geographical constraints.

Keywords: Knowledge adoption, Kinnow growers & drip irrigation

Introduction

In India, Citrus is 3rd largest fruit crop after Banana and Mango. The Kinnow (*Citrus nobilis*) is a well-known citrus fruit regarded for its pleasant flavor, shape, colour, taste, good yield, high processing value, medicinal applications, tasty juice, smoothing character, source of vitamin C, and high nutritional value. In the present time where agricultural scenario is changing, we are shifting towards precision farming and water management technologies mainly micro irrigation technologies (Drip and sprinkler irrigation etc.), which are capable of optimum utilization of water.Horticulture crops cultivation is increasing in the agriculture sector day by day, and it provides employment to rural and urban population, nutrient value, poverty alleviation, enhancement in living standard of people. The northern region of Rajasthan is known for its cereals production and Kinnow cultivation which is a very important fruit in the citrus family. The agro-ecological conditions of districts Sri Ganganagar and Hanumangarh of Rajasthan are well suited for cultivation of Kinnow on large scale. Presently Kinnow area in Sri Ganganagar is 12,079 ha and production 3, 20,000 MT, followed by 9009 ha and production 2, 15,308 MT in year 2019-20. Kinnow cultivation has proved a boon for cultivators due to its higher economic return as compared to other fruits crops. The low productivity of Kinnow in sub-tropical area is the major problem to enhancing the overall production of Kinnow in the country. The demand of citrus is continuously increase but due to low area under Kinnow cultivation and too much area which is agriculturally suitably is lack in water management and using for development of industrialization is a major problem to enhance the overall production and productivity of Kinnow. The production of Kinnow fruit will increase through effective production technologies like improved seedlings and water management techniques like drip irrigation system etc. It has been seen that there a great opportunity to enhance the production and productivity of Kinnow through provide effective and efficient water management technologies to the Kinnow growing farmers. The Kinnow fruit necessitates frequent and adequate irrigation; if irrigation is not provided on time and in sufficient quantity, the resulting fruits are of poor quality, and yield is reduced. Keeping in view present research study design with following two specific objectives:

1. To ascertain the knowledge of Drip irrigation system of Kinnow cultivators.
2. To examine the extent of adoption of Drip irrigation system of Kinnow cultivation.

Materials and Methods

The research was carried out in the Sri Ganganagar district of Rajasthan, which is the highest Kinnow producing district in the Rajasthan. There are 10 blocks of Sri Ganganagar district, out of these two blocks namely SGNR and Padampur purposively selected for the study purposes. Two villages from each block were selected randomly. From each village, 20 respondents were chosen using a randomly

and thus forming total number of 80 farmers, as the sample size of the study. For explore the level of knowledge about drip irrigation in Kinnow cultivation practice a multiple-choice questions administered in to the respondents. Correct answers received a score of 1, while incorrect answers received a score of 0. Each respondent's scores were added up, and based on the overall scores; respondents were categorized into three levels High, Medium, and Low with the help of mean and standard deviation. The extent of adoption of the respondents was assessed using a three-point continuum scale, with completely adopted, partially adopted, and non-adopted categories, and scores of 3, 2, and 1 were assigned, respectively, based on the responses.

$$\text{Extent of adoption} = \frac{\textbf{Area under Drip Irrigation}}{\textbf{Total area under kinnow cultivation}} \times 100$$

The data gathered from primary and secondary sources was analyzed using appropriate statistical techniques.

Results and Discussion

Knowledge of respondents about using Drip irrigation system in Kinnow cultivation

Knowledge was assessing responders' understanding of a variety of characteristics of drip irrigation systems in kinnow production. All knowledge portions have been grouped into six distinct groups: general irrigation/DIS aspects, product quality and yield, technical aspects, preventative strategies for drip irrigation systems, managing natural resources, and financial aspects.

Perusal of table 1 indicated that more than half (68.75%) of the respondents (using drip irrigation system) were aware of the largest area under drip irrigation system. More than half 60 percent of the respondents (using drip irrigation systems) were aware from ‘Per drop more crop’ is the tag line for which of the following irrigation systems under PMKSY.

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Table 1: Item wise knowledge about drip irrigation system in kinnow cultivation. (N=80)

S. No.	Aspects	Drip irrigation system (DIS)	
		Frequency (%)	Overall Rank
A. General aspects of DIS			
1.	In India, the drip irrigation technology covers the most area.	55 68.75%)	XIV
2.	Irrigation technology in which disease occurrence is extremely not feasible.	54 (67.5%)	XV
3.	Per drop more crop’ is the tag line for which of the following irrigation systems under PMKSY,2015.	50 (62.5%)	XVII
4.	Method of irrigation in which the amount of water can be easily measured.	60 (75%)	IV
5.	Irrigation system with great water efficiency if properly maintained.	60 (75%)	IV
B. Kinnow quality and yield			
6.	The long-term effect of a Drip Irrigation System on Kinnow Plant Quality.	56 (70%)	XI
7.	The impacts of drip irrigation on the root growth and development of the kinnow plant.	63 78.75%)	II
C. Technical aspects			
8.	Relevant water source for drip irrigation system.	48 (60%)	XIX
9.	Water conservation in kinnow orchards utilizing a drip irrigation system.	49 61.25%)	XVIII
10.	Depth of mains and sub-mains beneath the soil surface to prevent inter-culture damage and degradation due to UV rays.	59 73.75%)	VII
11.	Appropriate time to use the DIS.	56 (70%)	XI
12.	Optimal time to establish a drip irrigation system in kinnow orchards.	63 78.75%)	II
D. Preventative strategies for drip irrigation systems			
13.	Drip irrigation system quality component mark.	58 (72.5%)	IX
14.	Acid is used to algae and germs out from growing in drip pipes.	58 (72.5%)	IX
15.	Filter used for filtering algal/living harmful substances from water.	56 (70%)	XI
E. Managing natural resources			
16.	The effect of a drip irrigation system on the kinnow crop's fertilizer requirements.	70 (87.5%)	I
17.	The impact of drip irrigation on soil nutrients.	52 (65%)	XVI
F. Financial aspects			
18.	Average cost of Drip Irrigation System installation per hectare (If a water tank is available).	60 (75%)	IV
19.	The Rajasthan government provides a subsidy for drip irrigation systems through the Soil Conservation Department.	59 (73.75%)	VII

In case of Kinnow quality and yield, 75% of drip irrigation users were aware of the beneficial effect of drip irrigation systems on kinnow plant quality. 65 percent farmers had knowledge of impact of DIS on growth of root of kinnow plants. Whereas in case of technical aspect, 87.5% of drip irrigation users were aware of the proper source of irrigation

for their drip irrigation system.

About 75% of drip irrigation users were aware of the extent of water savings in kinnow orchards using drip irrigation technology (70%) were aware of the depth of mains and sub-mains below the ground's surface to avoid damage during inter-culture and deterioration due to sunlight, while a large percentage of drip irrigation users 75% were aware of the best time to operate a drip irrigation system.

While in terms of drip irrigation system precautionary measures, 73.75 percent of drip irrigation customers were aware of the quality component mark used in drip irrigation systems. It was also shown that knowledge about the acid used to guard drip pipes against algae and bacteria growth, as well as the filter used to separate algal and living contaminants in water, was possessed by 72.5% of drip irrigation users, followed by 78.75% of drip irrigation users, respectively.

Under natural resource management aspects, knowledge regarding the effect of drip irrigation systems on the fertilizer requirement of the kinnow crop was possessed by 70 percent of drip irrigation users, while 61.25 percent of drip irrigation users had knowledge about the effect of drip irrigation systems on micronutrients. Regarding economics aspects, 72.5 percent of drip irrigation users were aware of the average cost of installing a drip irrigation system per hectare (if a water tank is available), while 78.75 percent were aware of the subsidy provided by the Rajasthan government on drip irrigation systems through the Soil conservation department. Based on overall ranking it was concluded that majority of drip irrigation users were aware of the proper source of irrigation in kinnow (I), followed by Optimal time to establish a drip irrigation system in kinnow orchards (II), the impacts of drip irrigation on the root growth and development of the kinnow plant (II), Irrigation system with great water efficiency if properly maintained (IV), Method of irrigation in which the amount of water can be easily measured (IV) with the 87.5%, 78.75%, 78.75%, 75%, and 75% respectively.

The data presented in table 1 also indicated that, more than half (68.75%) of the respondents (using drip irrigation system) were aware of the largest area under drip irrigation system in India. In case of Kinnow quality and yield, 75% of drip irrigation users were aware of the beneficial effect of drip irrigation systems on kinnow plant quality. 65 percent farmers had knowledge of impact of DIS on growth of root of kinnow plants. In terms of technical considerations, 87.5% of drip irrigation users were aware of the proper source of irrigation for their drip irrigation system. 75% of drip irrigation users were aware of the extent of water savings in kinnow orchards using drip irrigation technology. From the table it is concluded that drip irrigation system precautionary measures, 73.75 percent of drip irrigation customers were aware of the quality component mark used in drip irrigation systems.

Overall knowledge level of kinnow growers using drip irrigation system

The data presented in table 2 indicated that nearly **2/3rd** (66.25%) kinnow growers, which used DIS had medium level of knowledge followed by 18.75% and 15% high and low level of knowledge in using DIS, respectively.

Table 2: Overall knowledge level of kinnow growers using drip irrigation system.

Knowledge level	f	%
Low (up to 11.64)	8	10.00
Medium (11.64 -15.5)	58	72.50
High (>15.5)	14	17.50
Mean= 13.57, S.D = 1.93		

Area wise extent of adoption of recommended DIS practices

The perusal of table 3 indicated that kinnow orchard soil testing, 61.25 percent of respondents have full adoption level, while 30% and 8.75% indicated partial adoption and non-adoption, respectively. In relation to of drip irrigation management, 87.5% of respondents had fully implemented a drip irrigation system in their kinnow orchard, while 12.5% had only partially implemented it. 47.5 percent of respondents indicated full adoption for recommended irrigation interval in kinnow orchard, whereas 36.25% and 16.25% indicated partial adoption and non-adoption, respectively. The finding of results revealed that little less from 3/5th (58.75%) of respondents were found to have fully implemented intercropping in kinnow orchard in the initial years of planting, while 28.75% were found to have partially adopted it, and the remaining 12.5% had not adopted it at all. The majority of respondents (40%) were found to have fully embraced the cultivation of suggested intercrops in kinnow orchards throughout the juvenile period, whereas the remainder 33.75% and 26.25% had partially adopted and had not accepted it, respectively.

In case of manure and fertilizer management, approximate half (48.75%) of respondents had fully embraced the recommended quantity of manure and fertilizer for kinnow orchard, whereas 33.75% had partially accepted it and 17.5% had not. For the prescribed amount of micronutrients every year for kinnow orchard, less than half (37.5%) of respondents were recorded as full adoption, while 45% and. 17.5% of respondents were recorded as partial and non-adoption, respectively. The table 2 concluded that in respect of plant protection, half (50%) of respondents were found to have completely put into effect the recommended insecticides for kinnow orchard, while 33.75% and 16.25 per cent were found to have partially adopted and not accepted it, respectively. For suggested fungicides for kinnow orchard, 45% of respondents indicated full adoption, while the rest 37.5% and 17.5% indicated partial adoption and non-adoption, respectively.

Table 3: Area wise extent of adoption of recommended DIS practices (N=80)

S. No.	Particulars	Fully adopted f (%)	Partially adopted f (%)	Non-adopted f (%)	Mean score	Overall rank
1.	**Soil Preparation**					
a)	Soil testing of kinnow orchard	49 (61.25%)	24 (30%)	7 (8.75%)	2.525	V
2.	**Plantation**					
a)	Purchase the plant material from the recommended source/agencies.	49 (61.25%)	24 (30%)	7 (8.75%)	2.525	V
b)	Recommended distance and spacing between plants.	50 (62.5%)	25 (31.25%)	5 (6.25%)	2.5625	III
3.	**Drip Irrigation Management**					
a)	Adoption of drip irrigation system in your kinnow orchard.	70 (87.5%)	10 (12.5%)	0	2.875	I
b)	Recommended irrigation interval in your kinnow orchard.	38 (47.5%)	29 (36.25%)	13 (16.25%)	2.3125	XII
c)	Adoption of fertigation unit in drip irrigation system.	39 (48.75%)	29 (36.25%)	12 (15%)	2.3375	X
d)	Adoption of pressure monitoring devices like pressure gauge.	53 (66.25%)	19 (23.75%)	8 (10%)	2.5625	III
e)	Recommended quantity of acid treatment for removing bacterial or algae formation from the drip pipes.	35 (43.75%)	27 (33.75%)	18 (22.5%)	2.2125	XVI
f)	Cleaning of drip lines on recommended time.	32 (40%)	31 (38.75%)	17 (21.25%)	2.1875	XVIII
g)	Measurement of discharge of emitter periodically to check clogging.	41 (51.25%)	27 (33.75%)	12 (15%)	2.3625	VIII
h)	clean filters properly before used for DIS.	39 (48.75%)	27 (33.75%)	14 (17.5%)	2.3125	XII
4.	**Intercropping**					
a)	Intercropping in kinnow orchard in the initial years of planting.	47 (58.75%)	23 (28.75%)	10 (12.5%)	2.4625	VII
b)	Cultivation of recommended intercrops in kinnow orchard at juvenile phase.	32 (40%)	27 (33.75%)	21 (26.25%)	2.1375	XIX
5.	**Manures and Fertilizers Management**					
a)	Recommended quantity of manures and fertilizers for kinnow orchard.	39 (48.75%)	27 (33.75%)	14 (17.5%)	2.3125	XII
b)	Prescribed quantity of micronutrients every year for kinnow orchard.	30 (37.5%)	36 (45%)	14 (17.5%)	2.2	XVII
6.	**Plant Protection Measures**					
a)	Recommended insecticides for kinnow orchard.	40 (50%)	27 (33.75%)	13 (16.25%)	2.3375	X
b)	Recommended fungicides for kinnow orchard.	36 (45%)	30 (37.5%)	14 (17.5%)	2.275	XV
7.	**Subsidy**					
a)	Subsidy support for DIS.	38 (47.5%)	32 (40%)	10 (12.5%)	2.35	IX
8.	**Firm/Dealer of DIS**					
a)	Purchase of drip irrigation system from recommended firms/dealers.	64 (80%)	15 (18.75%)	1 (1.25%)	2.7875	II

The perusal of table table 3 concluded that a little less than half of the respondents, 47.5 percent, completed implementation of the subsidised support, while 40% and 12.5% had partially adopted and had not adopted it, respectively. About 80 percent of respondents purchased their drip irrigation equipment from recommended firms or dealers, while 18.75% and 1.25% of kinnow growers purchased it partially and non- adoption fully, respectively.

Overall extent of adoption of DIS in kinnow cultivation practice

The results presented in table 4 clearly demonstrates that 30% of the respondents had a high degree of adoption, with medium (48.75%) and low (21.25%) levels following. It could be observed that 70% of the respondents had low to medium levels of adoption. This may be due to the respondent's moderate education, farming experience, medium innovative proneness, medium economic motivation, moderate risk orientation etc. or no proper technical guidance provided by extension agencies in the research area. The outcomes supported Singh and Singh's conclusions.

Table 4: Overall extent of adoption of DIS in kinnow cultivation practice. (N=80)

Extent of adoption	f	%
Low (<43.97)	17	21.25
Medium (43.97 – 47.30)	39	48.75
High (>47.30)	24	30
Mean = 45.6375		$\frac{1}{2}$S.D = 1.6635

This may be due to the respondent's moderate education, farming experience, medium innovative proneness, medium economic motivation, moderate risk orientation etc. or no proper technical guidance provided by extension agencies in the research area.

Constraints faced by the Kinnow growers

The table 5 indicated that economic constraints was the major constraints with the adoption of DIS in kinnow cultivation with mean 2.31, while Maintenance related constraints, educational constraints, technical constraints, Extension related constraints and Climate & Geographical constraints with mean 2.16, 2.1, 2.07, 2.05, and 1.9, respectively.

Table 5: Constraints faced by the Kinnow growers.

S. No.	Constraints	Mean	Rank
1.	Economic	2.31	I
2.	Maintenance	2.16	II
3.	Educational	2.1	III
4.	Technical	2.07	IV
5.	Extension	2.05	V
6.	Climate and Geographical	1.9	VI

Conclusion

It is concluded that nearly 2/3rd (66.25%) kinnow growers, which used DIS had medium level of knowledge followed by 18.75% and 15% high and low level of knowledge in using DIS, respectively. About 30% of the respondents had a high degree of adoption, with medium (48.75%) and low (21.25%) levels following. It could be observed that 70% of the respondents had low to medium levels of adoption. The major constraints faced by Kinnow growers were Heavy initial investment, expensive maintenance and managerial cost, adequate number of demonstrations were not arranged to motivate and develop skills for its adoption. To strengthen the adoption of drip irrigation systems the government. will have to give much subsidy to adopt DIS, demonstration, conduct farmer field school, training for both farmers, promote market access and extension personnel.

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