International Research Journal of Natural and Applied Sciences
ISSN: (2349-4077)
Impact Factor 7.032 Volume 11, Issue 07, July 2024
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CLIMATE INFLUENCE ON KINNOW PRODUCTION IN UTTAR PRADESH: A COMPREHENSIVE STUDY

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Abstract

Kinnow, a mandarin hybrid, is gaining popularity among the citrus growers of North West India. It is an important fruit crop due to the large amount of vitamin "C" that it contains. Kinnow (Santra) is also known as Citrus reticulata, which is a member of the Rutaceae family. In this study, we collected data regarding the marketing of kinnow, the average returns, the operational and maintenance expenses, and the setup costs. The data was analyzed in order to investigate the effectiveness of marketing, the pricing spread, margins, and budgetary constraints. The results showed that the most expensive labor per acre was spent on family labor (in the year 1212), followed by hired labor (In the year 732) across all categories of orchard size groups. The overall per-acre yields of medium orgrids were the highest (7385), while the yield of small orgrims was the lowest (6774), and the yield was the highest (6562). There was a favorable link between the age of the plants and yields (P0.05).

Keywords: Climate change, Kinnow, Orchard, Uttar Pradesh, Yields

Introduction

Kinnow, a mandarin hybrid, is gaining popularity among the citrus growers of North India. Its easy adaptability to varied agro-climatic conditions, heavy bearing potential and excellent fruit quality characters have boosted its cultivation. In recent years, North West India has been confronted with significant challenges in terms of preserving crop yield and agricultural income. These challenges include climate change, deteriorating soil health, and depleting groundwater.). India is the second largest producer of fruits in the world, behind only China, because it accounts for 10.9% of the total global fruit output. The total amount of fruit that was produced in India in 2013–2014 was 88.97 million tons, and it was grown on an area that was 7.21 million hectares. The citrus fruits account for 13.6% of India's total fruit crop, followed by bananas at 10.3%. Mangoes make up 36.7% of India's total fruit crop. Uttar Pradesh may anticipate an increase in average temperatures of 2.2-2.8 and 4.7-5.5 degrees Celsius, as well as an increase in rainfall of 159-354 millimeters, over the middle of the century (2020-2050). Diversification has the potential to play a vital role in the stabilization of agricultural revenue and the improvement of sustainable lives for farmers in the face of

climate change. In addition, the rice-wheat crop cycle system can generate soil fatigue, which can be alleviated by the utilization of diversification, which is an essential method. Consequently, if you are interested in diversifying your crop production in states like as Uttar Pradesh and Haryana, and even in certain regions of Rajasthan, you should think about cultivation of fruit crops.

In fact, one of the biggest environmental problems of the twenty-first century is climate change. Natural variations and outside factors, such as variations in solar radiation, volcanic eruptions, and natural variability within the climate system, have influenced the Earth's climate throughout its history and contribute to the overall natural variability of the climate system. These changes persist over long periods, frequently spanning decades or even longer. But over the past few centuries, human activity particularly since the industrial revolution has significantly altered the makeup of the atmosphere. In spite of a changing climate, climate-resilient agronomy aims to maintain sustainable food production and stable livelihoods for farmers. (Singh *et al.,* 2023). By fixing atmospheric nitrogen, both in conjunction with plant roots and independently, biofertilizers (*Azotobacter* and *Azospirillum*) solubilize insoluble soil phosphates and generate plant growth components in the soil, so contributing significantly to improved soil fertility. (Lokendra *et el.,* 2024).

Nano-technology offers great potential to tailor fertilizer production with the desired chemical composition, higher nutrient use efficiency that may reduce environmental impact and boost the plant productivity. Nano- fertilizers are very effective for precise nutrient management in precision agriculture by matching with the crop growth stage for nutrient and by providing nutrient throughout the crop growth period. Nano-fertilizers are new generation of the synthetic fertilizers which contain readily available nutrients in nano scale range. Nano-fertilizers are preferred largely due to their efficiency and environment friendly nature compared to conventional chemical fertilizers. The nano-fertilizers deal with the elements in nano- meter dimensions. (Singh *et al.,* 2024) Phosphorus regulates protein synthesis in plants, because it is a component of the complex nucleic acid structure. Phosphorus is also important in cell division and development of new tissues. (Singh *et al.,* 2022). Development of semi dwarf varieties of crops reduced the problem to some extent, but not completely. Use of higher level of fertilizers, irrigation and sometimes reverting to older cultivars for specific needs and increase in the mechanized harvesting may lead to further losses due to lodging. Presently, development of new varieties for higher yields has reached a plateau and no further increase is achieved unless biotechnological interventions are made. Lodging is the state of permanent displacement of the stems from their upright position. (Archna, *et al.,* 2023).

As a member of the Rutaceae family, the Mandarin Kinnow (Santra), also known as Citrus reticulata, is an important fruit crop due to the large amount of vitamin "C" that it contains. A total of 7.9 million hectares are used for agricultural purposes around the globe, which results in an estimated 3.84 million metric tons of fruit consumption. India is ranked tenth among the top nations that produce Kinnow (Santra), and it is responsible for three percent of the total fruit production anywhere in the globe. Many states in India, including West Bengal, Punjab, Madhya Pradesh, Uttar Pradesh Maharashtra, Rajasthan, Assam, and Karnataka, are responsible for the production of a significant quantity of Kinnow (Santra)s. India is responsible for the production of 3,431 million tons of rice, with a total area under Kinnow (Santra) that is 330,000 hectares and a yield of 10.4 metric tons per hectare. Punjab

is by far the most significant of all the states that are responsible for the production of Kinnow (Santra). The most productive region for the cultivation of Kinnow (Santra) fruit is Maharashtra, which has an area of 105.47 thousand hectares and produces 716.07 million tons of the fruit.

Research Methodology

In order to select kinnow farmers from each district, block, and hamlet, the researchers utilized a sampling procedure that consisted of multiple stages. Following that, two villages were selected from each block determined by the amount of land that was being used for kinnow agriculture, and three blocks were selected from each district. A random selection of 108 kinnow farmers was made from each community in order to guarantee that the sample would be representative of the whole. In order to collect the required information, personal interviews were carried out according to timetables that had been meticulously designed and tested. Small farmers (2.51-2.50 acres), medium farmers (5.01-7.50 acres), large farmers (above 7.50 acres), and marginal farmers (0.01-2.50 acres) were the four groups that were formed from the individual farmers. Even if all of the several categories of holding sizes (marginal, small, medium, and huge) were taken into consideration according to the national standard, the survey was unable to locate a single grower wh ose orchard was located on more than 7.50 acres of land. This limitation meant that the study could only look at data from a limited selection of landowners, which were referred to as marginal, small, and medium landowners. Throughout the course of 2009 and 2010, we acquired data regarding the marketing of Kinnow, the average returns, the operational and maintenance expenses, and the setup costs.

Economic Viability

We found that the following data points were documented: vine length in meters, leaf count per vine, days to first bloom, days to first harvest, fruit count per vine, fruit weight in grams, fruit yield per vine in kilograms, and fruit yield per hectare. The cost of cultivation and the price of fruit during that time were considered for the aim of determining the economics. Five Kinnow (Santra) plants and average-sized melons were chosen for each region in 2017, 2018, and 2019. To find the benefit-cost ratio (B:C), divide the absolute net return by the cultivation expenditures each day. Then, divide the total net return by the total net return each day, up to the length of the crop, to find the daily productivity (in kilograms per hectare) and total yield (in rupees per hectare).

Marketing Analysis

The data was analyzed in order to investigate the effectiveness of marketing, the pricing spread, margins, and budgetary constraints. Adjustments were made to the equations in order to estimate the producers' share, marketing margins, and marketing loss, as well as to separate the "post-harvest losses during marketing" at various stages of marketing. Additional goals included estimating the marketing loss.

Results and Discussion

Cost Analysis

The profits and expenses of kinnow orchards over the course of several years were computed by using annual monetary inflows and outflows as the basis for the calculation. There were a variety of expenses that were included in the establishing cost, including land preparation, excavation, filling, planting, planting materials, input costs, and so on. A wide

variety of expenses, including labor, fertilizers and manures, irrigation, training and pruning, and so on, were included in the operating cost. When calculating the cost of maintaining orchards, the quantity of inputs that were consumed by each plant was taken into consideration. In contrast to Nagpur (orange) mandarins, which can provide economic returns for as long as thirty years, kinnow orchards start producing returns in the fifth year and continue to do so for more than twenty-eight years (Gupta and George, 1974).

Table 1. Operation-wise first year establishment cost under different size groups of kinnow orchards

Rem	Marginal	Small	Medium	Overall
Preparation of land	1106	1154	1011	1114
Digging, filling and planting	1630	1601	1525	1621
Planting material	342	380	358	351
Irrigation	96	84	105	94
Training/ Pruning	38	38	ao	38
Manures + Fertilizers	254	259	433	260
Plant protection	0	11	47	4
Interest on working capital	432	457	441	438
Land revenue	0	0	0	0
Depreciation	125	127	165	127
Earned value of rented land (EVRL)	1094	1129	1231	1105
Interest on fixed capital	146	151	168	148
Total	5263	5391	5524	5298

This was accomplished by increasing the amount of fertilizers and plant protection chemicals that were applied. Small growers come in second with a cost of 5391 per acre, followed by marginal producers with a cost of 5263 per acre. Medium growers had the highest cost, which was 5524 per acre. When these data are taken into consideration, Gangwar and Singh (1998) and Gangwar et al. (2005) are able to be accepted.

Table 2. Year wise establishment cost under different size groups of kinnow orchards

Year	Marginal	Small	Medium	Overall
I	5263	5391	5524	5298
U	2365	2557	2750	2418
III	2445	2570	2848	2484
IV	2475	2573	2821	2507
Total	12548	13091	13943	12707

The annual establishing costs for kinnow cultivation are presented in Table 2, which covers a period of up to four years. It demonstrates that the first year was the most expensive for all size groups, and that succeeding years required forty to fifty percent of the expense of the first year until the plant began generating fruit. In the second year and beyond, the expenses were rather low, mostly because these were only required for the aftercare. This was

the primary reason for this. The construction of kinnow orchards costs an average of 12707 dollars per acre, whereas marginal orchards cost 12548 dollars per acre, small orchards cost 13091 dollars per acre, and medium orchards cost 13943 dollars per acre.

The operating expenses of the kinnow production are broken down into item-wise and concept-wise categories in Table 3. There was an increase in all three costs—cost A, cost B, and cost C—as the size of the farm increased.

Table 3. Item-wise and concept-wise operational costs under different size groups of kinnow orchards

SI. No.	Item	Marginal	Small	Medium	Overall
I	Hired human labor	711	804	741	732
2	Irrigation	0	0	0	0
3	Training/ Priming	93	140	196	106
4	Manures + fertilizers	118	295	195	159
5	Plant protection	17	39	36	22
6	Interest on working capital	113	153	140	122
7	Land revenue	0	0	0	0
8	Depreciation	124	142	165	129
9	EVRL•	1310	1349	1427	1322
10	Interest on fixed capital	172	179	191	174
11	Family hwnan labour	1250	1087	11%	1212
12	Cost A(I-6)	1051	1430	1308	1142
13	Cost6(I-10)	2657	3101	3092	2768
14	CostC(1-11)	3907	4188	4288	3980

The prices were $1142, $2768, and $3,980 per acre, respectively, for the total amount involved. According to the figures, family human labor was responsible for a sizeable share of the costs involved with the upkeep of the kinnow orchards. This amount accounted for a staggering 30.46 percent of the overall expenditures for the entire period. The most expensive labor per acre was spent on family labor (in the year 1212), followed by hired labor (in the year 732) across all categories of kinnow orchard size. Taking into consideration the fixed costs, the most significant sum was incurred by EVRL ('1322). The expansion of orchards onto bigger areas led to an increase in the overall operational expenses sustained.

Returns

Table 4. Average returns under different age groups of kinnow orchards

Age of plants	Marginal	Small	Medium	Overall
Up to 10 years	5526	5863	6236	5621
1 I° to 15° year	6785	6954	7257	6836
Above 15° year	6954	7125	7966	7020
Overall	6562	6774	7385	6632

In kinnow orchards, there was a favorable link between the age of the plants and the yields (Table 4). After 15 years, the returns per acre were highest in medium orchards ('7966), followed by small orchards ('7125), and marginal orchards ('6954) were the least profitable. Additionally, the overall per-acre yields of medium orchards were the highest (7385), while the yields of small orchards were the lowest (6774), and the yields of marginal orchards were the highest (6562). The findings indicated that the earnings would be higher proportionately to the size of the orchard, which is consistent with the concept of economies of scale in manufacturing. **Conclusion**

This study focuses on the impact of climate conditions in Uttar Pradesh on the production of Kinnow, a mandarin hybrid fruit. The research collected data on marketing, returns, expenses, and setup costs of Kinnow orchards. Analysis revealed that the most expensive labor per acre was family labor, followed by hired labor across all orchard size groups. Medium orchards had the highest yields, while small orchards had the lowest. The age of plants showed a favorable correlation with yields. Economic viability was assessed through benefit-cost ratios, net returns, and productivity. Marketing analysis looked at pricing spread, margins, and losses. The study concluded that larger orchards had higher returns, consistent with economies of scale in production. The findings highlight the importance of considering climate conditions and costs in citrus fruit cultivation in Uttar Pradesh.

References

Acharya, S. S. and Aggarwal, N. L. (2021) Agricultural Marketing in India. Oxford & IBH Publishing Company, New Delhi.

Anonymous (2020) Available at www.marketpublisher.com.

Archna, K., Singh, V., Kumar, H., and Singh, R. (2023) Optimization of NPK fertilization in conjunction with Plant Growth Regulators (PGRs) affecting productivity and profitability of wheat (*Triticum aestivum* L.). *The Journal of Rural and Agricultural Research Volume 23 No. 2, 56-60.*

Banerjee, G. D. (2019) Poised for a golden revolution. Times Agriculture Journal, 01 April.

Bhat A, Kachroo J and Kachroo D. 2019. Economic appraisal of kinnow production and its marketing under North-Western Himalayan Region of Jammu. Agricultural Economics Research Review 24 (2): 283–90.

Government of India. 2019. Agricultural Statistics at a Glance, Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

Kamboj M, Mehta S K, Bhatia R, Kamboj R and Mehta G. 2019. Communication behaviour of kinnow growers in Haryana. Advances in Social Research 2(1): 33–9.

Kaur M and Singla N. 2020. An economic analysis of kinnow cultivation and marketing in Fazilka district of Uttar Pradesh. Indian Journal of Economics and Development 12(4): 711–8.

Ladaniya, M. S., Wanjari. V. and Mahalle, B. C. (2020) Marketing of grapes and raisins and post-harvest losses of fresh grapes in Maharashtra. Indian Journal of Agricultural Research, 39(3): 167-176.

Lepeha, Y., Ali, Md. H., Maity, A., Mukherjee, A. K. and Chattopadhayay, T. K. (2019) Economics of marketing of mandarin orange in Darjeeling district of West Bengal. Economic Affairs, 38(4): 232-241.

Lokendra P. S. Virendra S., Vishal G., Harish K., Karan S., Mohd. A., Rahul S., Suraj K., Anubhav S., Anoop S., Sonia, D.S. Chhonker and Jitendra K. Improvement of productivity and profitability in wheat by nitrogen and bio-fertilizer in north western plain zone. *Int. J. Res. Agronomy,* 2024;7(1):289-292. DOI: 10.33545/2618060X.2024.v7.i1d.232

Pal A. 2016. Soon, savour 'seedless' kinnow, Accessed on 28 Jan 2019 from https://www.tribuneindia.com/news/Uttar Pradesh/soonsavour-seedless-Kinnow/196478.html

Prakash P, Jaganathan D, Sivakumar P S, Immanuel S, Kishore P and Kumar P. 2019. Does APMC market increase farmer's income? Evidence from value chain analysis of sweet potato in Karnataka. Indian Journal of Agricultural Economics 73(3): 342–57.

Price, Gittinger, J. (2019) Economic Analysis of Agricultural Projects. Economic Development Institute, International Bank for Reconstruction Development, Washington D. C., USA.

Romana G S and Sachdeva J. 2019. Economics of kinnow marketing in Uttar Pradesh vis-à-vis distant markets: a case study. Indian Journal of Economics and Development 11(3): 761–6.

Sharma, S., Singh, B., Rani, G., Zaidi, A. A., Hallan, V., Nagpal, A. and Virk, G. S. (2019) Production of Indian citrus ringspot virus free plants of kinnow employing chemotherapy coupled with shoot tip grafting. Journal of Central European Agriculture, 8(1): 1-8.

Sidhu R S, Vatta K, Kumar S and Singh P. 2021. Production and marketing system for kinnow in Uttar Pradesh. Journal of Agricultural Development and Policy 22(1): 49–58

Singh, R., Singh, S., Singh, V., and Kuldip, H. K. (2024) Impact of nano-nitrogenous fertilization on productivity and profitability of Barley (Hordeum vulgare L.). The Journal of Rural and Agricultural Research Volume 24 No. 1, 110-114 (2024), DOI: 10.13140/RG.2.2.16387.72480.

Singh, V., Chhonker, D., and Singh, R. (2022). Effect of Phosphorus Levels on Growth and Yield of Kabuli Chickpea (*Cicer kabulium* L.) Varieties. The Journal of Rural and Agricultural Research Vol. 22 No. 2, 108-111.

Singh, V., Kumar, H. and Sonia (2023). Influence of Climate Change on Indian Agriculture" of published book entirled "Advances in Agriculture Science (Volume–44) having ISBN- 978-93-5570-856-4.

Sudha, M. and Reddy, Y. V. R. (2019) Economics of sweet orange cultivation. Indian Horticulture, 33(3): 24-25.

Thakur, D. S., Saibabu, M. V. S. and Sharma, K. D. (2020) Economics of kinnow cultivation in Himachal Pradesh. Himachal Journal of Agricultural Research, 12(1): 47-51.