



Assessment of Effect of Various Factors on the Growth of Productivity of Pomegranate plants

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ABSTRACT

Pomegranate (Punica granatum L.) is an important fruit crop and acts as a potential nutraceutical that can provide medical and health benefits, including the prevention and treatment of a disease. The aim of the present survey base study is to understand the effect of insecticides, fertilizers, and diseases on pomegranate fruits and their management by farmers. A total of 197 (98%) farmers believed in the use of pesticides for Pomegranate crop production. Most probably Monocrotofoss pesticide used by farmers 84 followed by Dimethoate, Imidacloprid, and Deltamethrin. Survey study report analysis showed that 194 (97%) farmers used fungicides the highest response for organic fertilizer (115), chemical fertilizer (48), and mixed fertilizer (38). The study showed that 174 (86%) farmers preferred the use of herbicides while 28 (14%) farmers did not use herbicides. Among 202 farmers, 116 farmers thought climate change caused of telya disease (oily spots) while 52 farmers thought Mucormycosis was caused by telya disease (oily spots) and 34 farmers believed that telya disease occurred due to untimely rain. A total of 59 farmers thought 10% of crops suffered from oily spot disease, 81 farmers thought 25% of crops suffered, 54 farmers believed 50% of crops suffered, and 8 farmers believed 100% of crops suffered due to oily spot disease. Farmers benefited from Pomegranate crop plantation, the average income from Pomegranate crops depends on the land used for the plantation. Some of them bore loss due to climate change, or improper planning.

Key words: Pomegranate, pesticides, insecticides, mucormycosis

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INTRODUCTION

Pomegranate (*Punica granatum L.*) is an important fruit crop in arid and semi-arid regions that originated in Iran. The arid region is characterized by high temperatures, low and erratic rainfalls with frequent drought; soils are poor in the availability of nutrients and water holding capacity. The environmental conditions of the arid region are very harsh for the sustainability of plants, hence; the selection of a fruit crop for such a region is important for economic production. In India, pomegranate is grown commercially in the states of Maharashtra, Gujarat, Karnataka, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, and Rajasthan. India is one of the major producers of pomegranate with the largest acreage in the world. During 2016-17, pomegranate was cultivated in over 2.16 lakh ha with an annual production of 24.42 lakh tonnes and productivity of 11.70 tonnes/ha in India. Maharashtra is the leading state with 65.51 percent of the area and 64.61 percent of total production under pomegranate [2].

India is the only country in the world where pomegranate is available throughout the year. Iran, India, China, Turkey, and the USA are major producing countries in the world with 76% of the total production. It is also grown in Afghanistan, Bangladesh, Myanmar, Vietnam, Thailand, Kazakhstan, Turkmenistan, Armenia, Georgia, Morocco, Tunisia, Egypt, Israel, Syria, Lebanon, Greece, Cyprus, Italy, France, Spain, Portugal, Mexico, Argentina, and Chile for table and ornamental purpose [7,8, 16].

Pomegranates grown in different parts of the country are transported to district places and big cities for marketing. The fruits produced in Maharashtra, Karnataka, Andhra Pradesh, and Gujarat find markets in Mumbai, Nagpur, and Kolkata. Solapur, Nashik, Satara, Sangli, Ahmednagar, Pune, Bijapur, Belgaum, Bagalkot, Anantpur, Bhavnagar, Ahmedabad, and Sabar-Kantha are the major markets in the district place. Besides, these there are also some important wholesale markets of pomegranates in Kolkata, Delhi, Mumbai, Chennai, Bangalore, and Nagpur.

It has enormous medicinal, and nutritional value and is one of the richest sources of antioxidants. A number of processed products such as juices, squash, jelly, anardana, and mouth freshener are prepared by processing fruit.

There are many commercial varieties that are cultivated in different parts of India Jalore Seedless is popular in Rajasthan while Bhagwa is the predominant ruling variety of India owing to its dark red arils and attractive red colour rind. Important varieties of pomegranate are Ganesh, Dholka, Bhagwa, PhuleArakta, and seedless varieties such as Paper Shell, Spanish Ruby, Mascut Red, and Velladu, which showed great potential. Earlier, the Ganesh variety with big-sized fruits was preferred, but presently soft seeded, red peel, and aril-colored varieties with a high percentage of juice are preferred such as Bhagwa and Mridula. In hot arid climatic conditions, the varieties like Jalore Seedless, Bhagwa, G-137, Mridula, Phule Arakta, and Ganesh are found promising [15].

Pomegranate can act as a potential nutraceutical that can provide medical and health benefits, including the prevention and treatment of a disease. Pomegranate contains agents like polyphenolic flavonoids, which deploy actions well conducive to good oral health; particularly in relation to gingivitis development [5, 26]. Pomegranate juice has the highest antioxidant potency composite index among beverages like Red wine, Blueberry juice, Acai juice, and Orange juice to name a few; and the antioxidant activity was at least 20% superior to any other beverages [14].

MATERIALS AND METHODS

Pomegranate (*Punicagranatum* L.) belongs to the Punicacea family, native to central Asia, notably Iran. Pomegranate is a fruit with a remarkably high content of carbohydrates, vitamins, and minerals. This fruit is cultivated in a great variety of regions in the world. This fruit attracts attention for its various benefits for human health. Pomegranate peel was reported to have antifungal and antibacterial activities. In addition, pomegranate juice was evaluated as a potential chemo-preventive agent for prostate cancer and the action of ellagic acid on proliferation by regulation of the cell cycle or induction of apoptosis.

There is so much literature explained about the importance of the Pomegranate plant. In India, specifically Maharashtra, most of the farmers preferred cultivation of Pomegranate plants. To understand the current situation of farmers related to the cultivation process, use of fertilizers specifically their preference for chemical, organic, and mixed fertilizers, the effect of fertilizers, the soil of the field, use of herbicides, pesticides, and fungicides, oily spot disease of plant and its effect on crop yield, the effect of climate and income from Pomegranate crop yield. So one google form was prepared and shared with farmers [17].

Google form for a survey: https://docs.google.com/forms/d/16V8IHhXIIYGwgeLN0k_YZvIkwo-rjsE0FFmhFn3rhmc/viewform?ts=623fee8a&edit_requested=true

RESULTS AND DISCUSSION

Pomegranate (*Punica granatum*) is one of India's most important commercial fruit crops. It has economic importance and is consumed fresh or in the form of juice, jam, squash, and syrup. Among all forms, canned slices and juice are in much demand in India, constituting about 70% of the production. In the present work, the effect of various factors on the growth of productivity of Pomegranate plants was studied. A Google form was prepared and distributed among farmers. A total of 202 farmers' data were received among them 190 (94%) farmers planted Pomegranates while 12 (6%) farmers have not planted Pomegranates (Figure4.1).

Pomegranate Crop Plantation

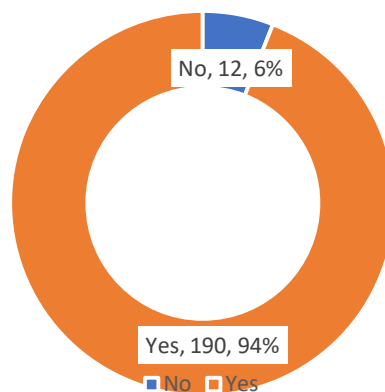


Fig. 4.1: Number and Percentage of Pomegranate Crop Plantations by Farmers

In the study, it was observed that the highest number of farmers (84) preferred plantation of Pomegranates at a distance of 12 to 10 feet followed by (62) farmers at 12 to 12 feet while (41) farmers planted Pomegranates at a distance of 12 to 8 feet (Figure.4.1).

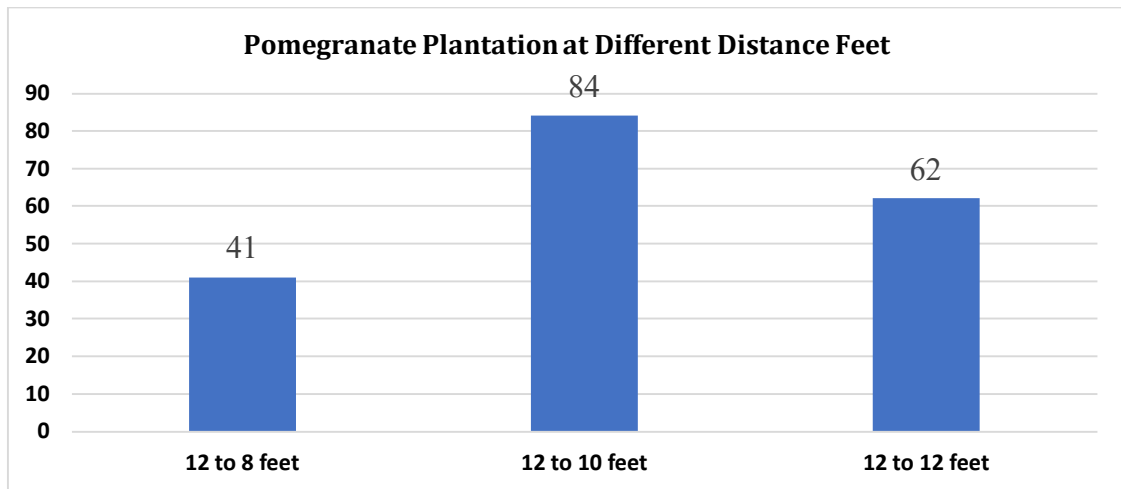


Fig. 4.2: Plantation of Pomegranate at Different Distance Feet

Soil is very important content for any kind of crop production and from the survey, it was observed that most of the farmers' field soil was black (67%) followed by murad soil (17%) and red soil (16%) Figure 4.2.

Healthy planting material is the first step for successful crop production, and this becomes all the more important in horticultural crops which are perennial. Pomegranate planting material especially air layers and stem cuttings, carry latent infections of threatening diseases like bacterial blight and wilt [18]. These diseases may express 5-12 months after planting in the orchard, thus introducing disease inoculums in new areas. In addition, several other pests may also be introduced. Hence, procuring healthy planting material from a reliable certified nursery is of paramount importance. In order to fulfill the growing demand for pomegranate planting material all over India, establishing disease-free reliable nurseries should be a top priority so that diseases are not introduced in new areas through infected planting material [19, 24].

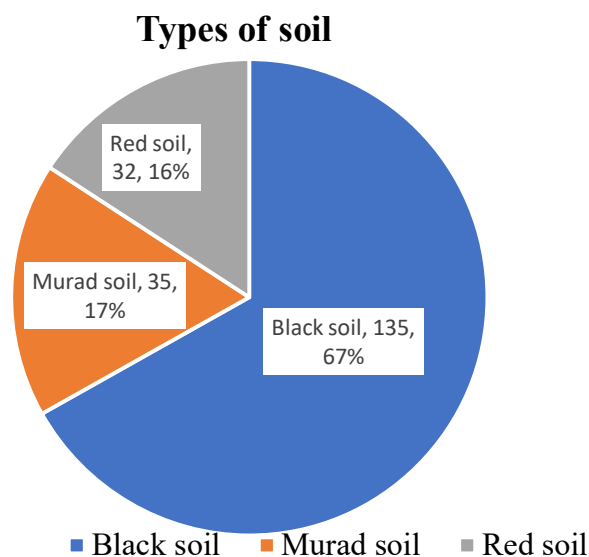


Fig. 4.3: Types of soil of SatanaTaluka

The Pomegranate adapts and develops to almost all soil types, regardless of composition or texture, provided they do not waterlogged. Of course, for each different soil type, proper cultivation practices must also be followed in order for Pomegranate trees to be productive. For example, in light sandy soils, the plants should be supported with irrigation and enhanced fertilization. However, the most favorable soil for the establishment of a commercial Pomegranate plantation is rich in organic matter alluvial sandy loam, which has excellent nutrient-holding capacity and drainage, while retaining the necessary moisture. Its depth should be at least 60 cm, but the best results are at high depths of 1.50m or more [4].

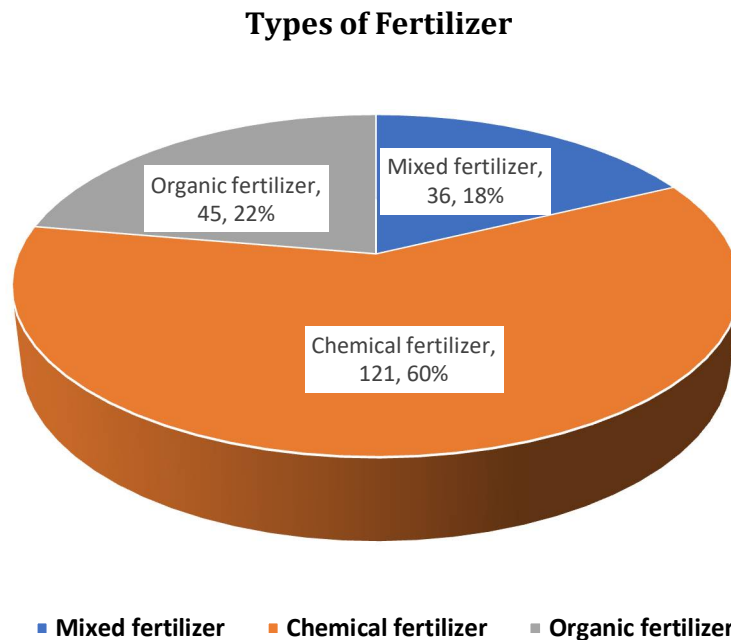


Fig. 4.4 : Types of fertilizer used by farmers for crop production from Satana Taluka

Fertilizer is a natural or artificial substance containing chemical elements that improve the growth and productiveness of plants. Fertilizers enhance the soil’s natural fertility or replace chemical elements taken from the soil by previous crops. Fertilizers can aid in making profitable changes in farming. Chemical fertilizers adversely affect soil fertility, biofertilizers were brought into use. These are substances that contain living or latent cells, and even microorganisms. They provide the soil with the necessary nutrients and microbes for the growth of plants. They help the soil to retain its fertility. They are environment-friendly and also destroy pathogenic components responsible for causing disease in plants. Acetobacter and Rhizobium are two widely used biofertilizers. From the Figure. 4.4, it was observed that chemical fertilizers were prominently used by farmers (121, 60%) followed by organic fertilizer (45, 22%) and mixed fertilizer (36, 18%). Table 4.1 showed that 189 (94%) farmers used organic fertilizers whereas only 13 (6%) farmers were not used organic fertilizers. It indicates that farmers believe the use of organic fertilizer is good for Pomegranate crop production.

Table 1 : Use of Organic fertilizer

Sr. No.	Yes	No
1	189 (94%)	13 (6%)

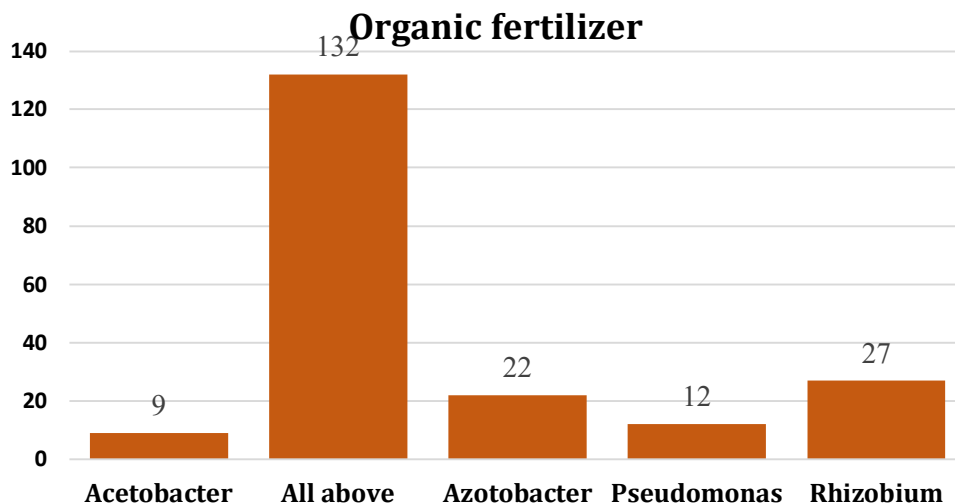


Fig. 4.5: Types of organic fertilizer used by farmers for Pomegranate crop production

In the present study, Figure 4.5. showed that a total of 132 farmers used all of the organisms as organic fertilizer such as Acetobacter, Azotobacter, Pseudomonas, and Rhizobium, whereas 27 farmers were Rhizobium followed by Azotobacter, Pseudomonas, and Acetobacter. The study survey report also showed (Table 2) that 141 farmers gained profit by using organic fertilizer while 48 farmers observed a positive response to organic fertilizer while 9 farmers bore loss due to the use of organic fertilizer while 4 farmers experienced a negative impact of organic fertilizers.

Table 2 : Effect of using organic fertilizer on pomegranate crop

Sr. No.	Profit	Positive	Loss	Negative
1	141	48	9	4

The use of organic sources of nutrients helps to conserve soil health by maintaining the equilibrium of organic matter and soil microflora ultimately helping to improve physical, chemical, and biological properties of the soil. The utility of neem and pongamia seed cake as a fertilizer as well as a pesticide on economically important crop species is well established [28]. Hence, this study is formulated to integrate bio-inoculants and organics for exploiting nutrient management in pomegranate.

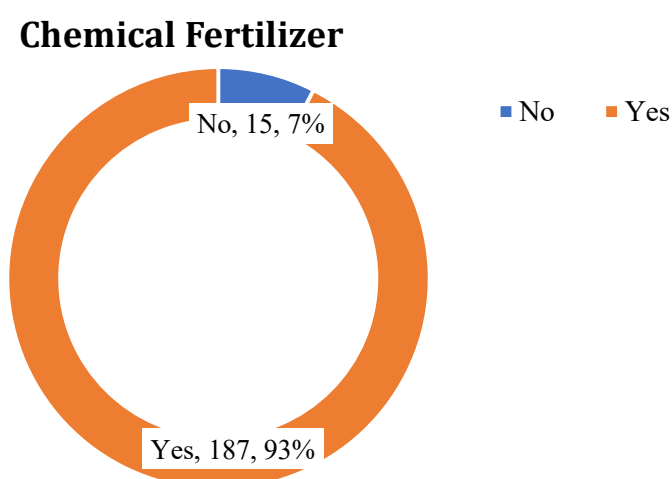


Fig. 4.6: Use of Chemical Fertilizer by farmers for Pomegranate Crop Production

From Figure 4.6, a total of 187 (93%) farmers used chemical fertilizers while only 15 (7%) farmers were not used chemical fertilizers. A total of 127 (63%) farmers used nitro-phosphate, superphosphate, and

urea while 34 (17%) farmers used urea, 23 (11%) farmers used superphosphate and 18 (9%) farmers used nitro-phosphate (Table 2).

Table 3: Types of Chemical Fertilizer Used By Farmers for Pomegranate Crop Production

Sr. No.	All above (Nitro-phosphate, Superphosphate, Urea)	Nitro phosphate	Superphosphate	Urea
1	127(63%)	18 (9%)	23 (11%)	34 (17%)

From the study, it was observed that 190 (94%) farmers believed that chemical fertilizers showed a positive response to Pomegranate crop production while only 12 (6%) farmers believed that chemical fertilizers were responsible for a negative impact on Pomegranate crop production.

Table 3: Recommendations Chemical Fertilizer for Pomegranate Plant

Fertilizers	One Year Plant	Five Years & Above Plant
FYM (Farmyard manure)	50-60 kg	50-60 kg
Urea	10-20 gm	50-60 gm
SSP (Single Super Phosphate)	150-300 gm	900-1200 gm
MOP (Monoammonium Phosphate)	90-120 gm	150 -200 gm

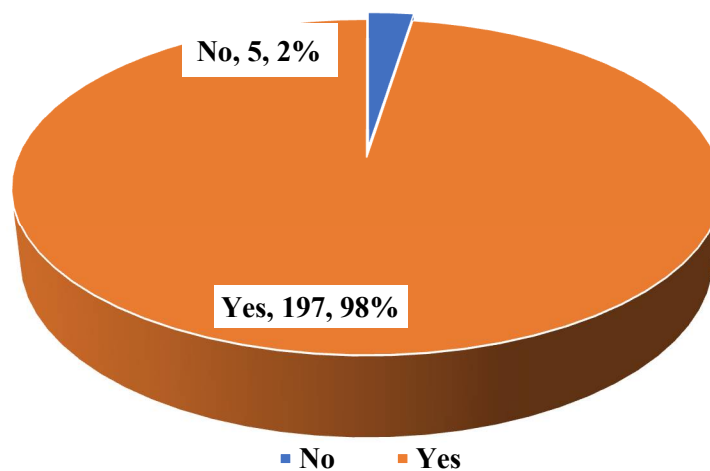


Fig. 4.7: Percentage of Farmers Who Used Pesticides in Pomegranate Crop Production

From Figure. showed 197 (98%) farmers believed in the use of pesticides for Pomegranate crop production while only 5(2%) farmers were not used pesticides. Pomegranate is affected by a number of diseases, insects, and pests [3]. Bacterial blight and wilt are severe threats to pomegranates in India, while in the hot arid region of Rajasthan nematode, fruit spots, mites, thrips, and termites are major problems.

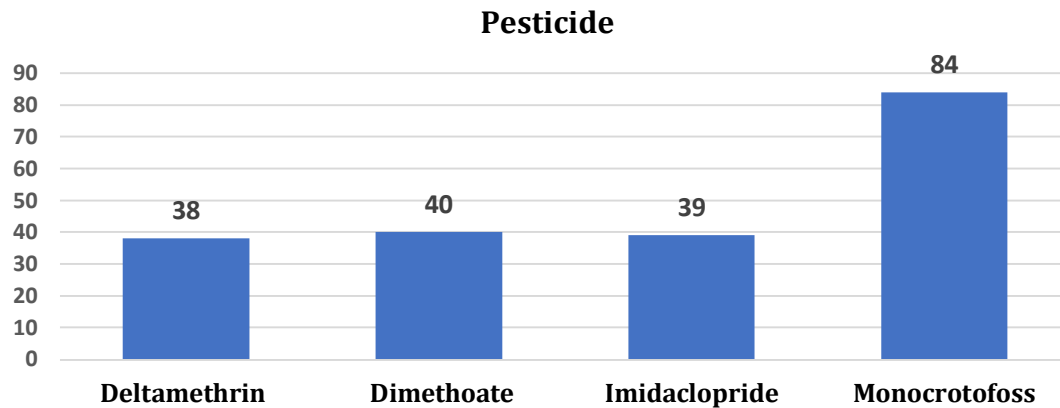


Figure4.8: Types of Pesticides Used By Farmers for Pomegranate Crop Production

Most probably Monocrotofofoss pesticide was used by farmers 84 followed by Dimethoate, Imidacloprid, and Deltamethrin (Figure4.8). Survey study report analysis showed that 194 (97%) farmers used fungicides whereas only 8(3%) were not used fungicides in Pomegranate crop production. Ecological engineering for pest management has recently emerged as a paradigm for considering pest management approaches that rely on the use of cultural techniques to effect habitat manipulation and enhance biological control. Ecological engineering for pest management is based on informed ecological knowledge rather than high-technology approaches such as synthetic pesticides and genetically engineered crops [26].

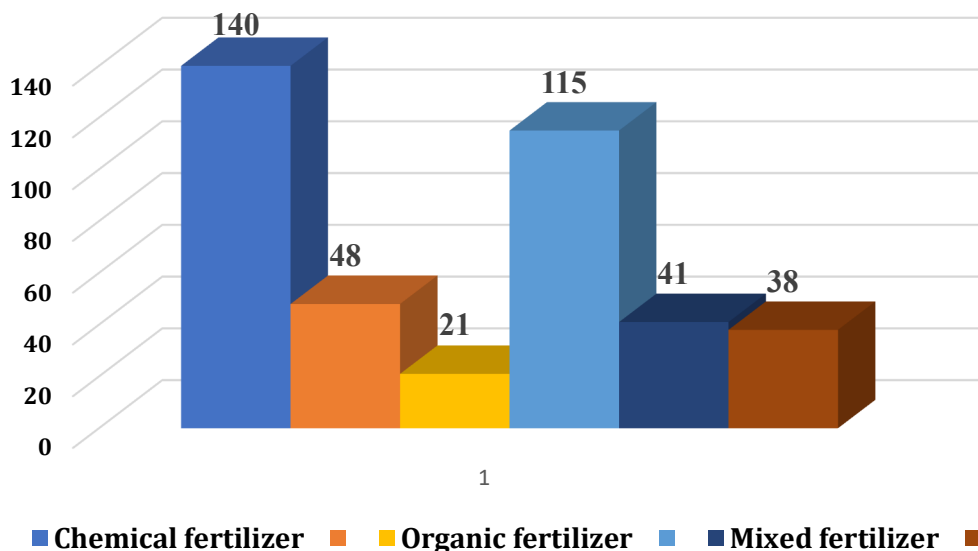


Fig. 4.9: Use of Fertilizers According To the Situation by Farmers

When the question was asked to the farmers, using which kind of fertilizer 'did you see the immediate effect' got the highest response for chemical fertilizer (140) followed by mixed fertilizer (41) and organic fertilizer (21). After that immediately another question was asked, which kind of fertilizers are best used for the immunity of plants? The response was completely changed, got the highest response for organic fertilizer (115), chemical fertilizer (48), and mixed fertilizer (38) (Figure 4.9).

HERBICIDES USE IN POMEGRANATE PLANTATION

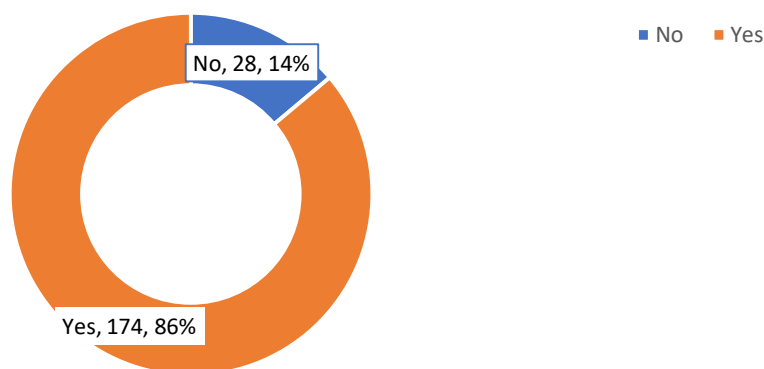


Fig.4.10: Number and Percentage of Farmers Who Used Herbicide on Pomegranate Plantation

Figure 4.10 showed that 174 (86%) farmers preferred the use of herbicides while 28 (14%) farmers did not use herbicides.

TELYA DISEASE (OILY SPOTS)

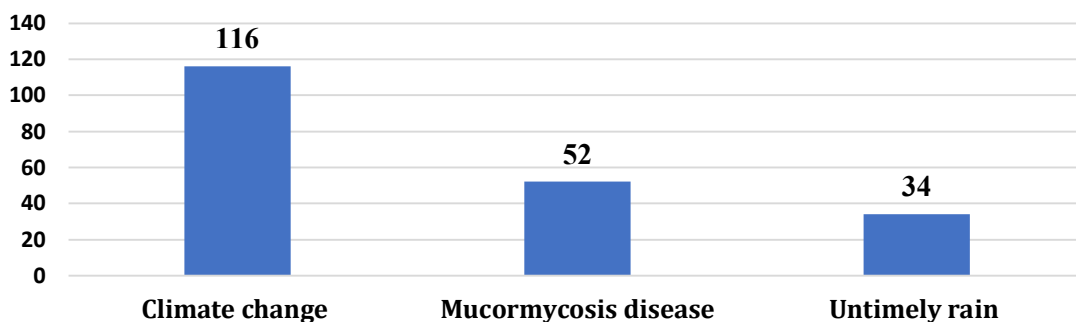


Fig. 4.11: Diseases on Pomegranate Plants during the Observation

When the question asked to farmers, did you observe oily disease on crops after planting Pomegranate? A total of 185 (95%) farmers replied yes while 17 (5%) farmers did not observe oily disease on crops after planting Pomegranate. Among 202 farmers, 116 farmers thought climate change causes of telya disease (oily spots) while 52 farmers thought Mucormycosis caused of telya disease (oily spots) and 34 farmers believed that telya disease occurred due to untimely rain (Figure 4.11).

Table 4: Percentage of Crop Is Suffered Due To the Oily Spots Disease

Percentage of crop suffered	10%	25%	50%	100%
No. of farmers	59	81	54	8

A total of 59 farmers thought 10% crop suffered from oily spots disease, 81 farmers thought 25% crop suffered, while 54 farmers believed 50% crop suffered and 8 farmers believed 100% crop suffered due to oily spots disease (Table 4).

Farmers benefited by Pomegranate crop plantation, average income on Pomegranate crop depends on land used for plantation. Some of them bore loss due to climate change, or improper planning [21].

The role and importance of nutrients in plant growth and development is undeniable. Plants need essential nutrients for mandatory growth and development [25]. NPK has a significant effect on pomegranate plants, but the combination of manure, foliar spray of micronutrients, and NPK is

recommended for optimum yield and quality. Torshiz *et al.*, (2017) studied the effect of organic and biofertilizers on pomegranate fruit quality and cracking. They observed that a combination of both organic and biofertilizers significantly reduced cracking while increasing yield per plant [27].

Leaf analysis of these plants showed a higher amount of macro and micronutrients in the leaf. Hepaksoy *et al.* (1997) stated that nitrogen has the most significant effect on fruit cracking; increasing levels of nitrogen favors fruit splitting because leaf and peel nitrogen levels are directly correlated. The potassium and calcium ratio in leaves has an effect on leaf physiology and functioning. The increasing level of leaf calcium and decreasing level of potassium have an effect on leaf succulence and gas exchange properties, ultimately on fruit cracking incidence as varieties with the highest leaf succulence and water use efficiency are less prone to fruit cracking [13]. Sheikh and Manjula (2012) studied the effect of boron, iron and calcium on pomegranate fruit cracking and concluded that all three micronutrients significantly reduced fruit cracking. Lower doses had more significant effect on fruit cracking compared with higher doses [23].

Samra and Khalil, (2014) and Ghanbarpour *et al.*, (2019) applied humic acid, kaolin, and calcium-boron for the control of pomegranate fruit cracking. This combination of above nutrients was proved to be beneficial in deficient irrigational conditions [20, 12]. Sharma and Belsare, (2011) also noticed the significant effect of boron and calcium on fruit cracking and concluded that different varieties showed variant responses to nutrients concentration [22].

Ahmed *et al.* (2014) used magnesium sulphate, chelated -Zn, boric acid and calcium chloride for controlling fruit cracking in pomegranate [1]. El-rhman, (2010) used kaolin, zinc sulphate and their combination for the control of fruit cracking. Both nutrients significantly reduced cracking with kaolin and 1% zinc sulphate [11]. Chater and Garner, (2018) used foliar application of zinc sulfate, magnesium sulfate, and potassium nitrate to control of fruit cracking in pomegranate. Results indicated an elevation in leaf Zn, N, K, and S contents, and a consequence fruit cracking was reduced [9]. Davarpanah *et al.*, (2018) reported decrease in pomegranate fruit cracking by using calcium chloride and calcium with nanoparticles. Nanoca followed by a foliar spray of calcium chloride has most significant effect in controlling fruit cracking [10]. Bakeer, (2016) Studied the effect of different doses of ammonium nitrate and calcium chloride on pomegranate plant vegetative parts and fruit quality and found that both fertilizers alone or in combination affect the nutritional status of leaves which ultimately reduces fruit cracking [6].

Pomegranate is marketed through cooperative marketing societies in Maharashtra where a group of pomegranate farmers join together on a cooperative basis to sell their produce. The growers finalize the picking and packing activity only after acceptance from the cooperative's society. After receiving the produce from the growers, the cooperatives society sends to commission agent. Scheduling the dispatch of consignments in respective lots is the responsibility of the cooperative's society. Transport cost is in the range of Rs. 4-10 per box. Another way is group arrangement, in which about 5 to 10 growers having mutual understanding make joint arrangement for sale of their produce. Some farmers are having contract system in which farmers sell their produce on plant without harvesting the fruits to the contractor directly or through middle man.

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