



TOMATO CULTIVATION UNDER NATURAL FARMING IN VILLAGE MAHOG OF DISTRICT SOLAN OF HIMACHAL PRADESH

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Abstract: The present study is an attempt to highlight tomato cultivation under natural farming in village Mahog of district Solan of Himachal Pradesh. The study is primarily based on primary data but for physical and socio-economic aspects of the village, secondary data are also utilized. The primary data regarding various agricultural operations or activities like nursery bed preparation, land preparation and transplantation, mulching to control weeds and moisture, intercropping, staking, irrigation, liquid and dry *khad* (manure), harvesting, and production and marketing of tomato under natural farming is collected from the farmers of village Mahog through structured interview method in 2020. Methods of doing natural farming under various agricultural operations or activities for tomato cultivation are highlighted in this study. The study emphasises that natural farming reduces the cost of farming and increases farmer's income. Natural farming should be adopted to protect human beings from the ill effects of chemicals and pesticides used in conventional methods of cultivation.

Keywords: Tomato, natural farming, transplantation, staking, mulching, production

1. INTRODUCTION

Natural Farming is a holistic agriculture practice that counters commercial expenditure and market dependency of farmers for inputs and nothing has to be purchased from outside. This method creates the ideal soil conditions for plant growth by substituting mixtures of cow dung, cow urine, jaggery, and pulse flour for fertilisers and pesticides. This mixture is known as *Jeevamrutham* and it can also be used to increase micro-organisms in soil. Coating of seeds by cow dung and urine is known as *Beejamrutham*; and to protect plants from pests, *Kashayams* is used and it is a mixture of lilac and chillies. Crop residuals can be used to protect the topsoil and retains soil moisture.

Himachal Pradesh have adopted natural farming in large scale and the government has implemented an innovative technique introduced by "Padma Shri" awardee Subhash Palekar (an agriculturist scientist) under Subhash Palekar *Prakritik Kheti Khushhal Kisan Yojana* to reduce the cost of farming and increases the farmer's income. The budget allotted for this purpose is Rs.19.25 crore in 2019-20. The government is providing a subsidy of 50 per cent to the farmers for purchasing cows of indigenous breed to promote natural farming in the state. Rs.8,000 are provided to the farmers to construct a pit in their *Gaushaala* (cowshed) to collect cow urine as well as three plastic drums are also given to the farmers to prepare manure etc.

Despite having other blocks in the Solan district, the main vegetable-growing regions of the state are the Kandaghat and Solan blocks, where the majority of farmers are small to marginal landholders. They get good returns by primarily cultivating cash crops including tomato, capsicum, pea, cauliflower, ginger, and French beans. In terms of area and production, tomatoes are the most widely produced vegetable in this region. According to 2016-17, this district produced 2,32,000 metric tonnes of tomatoes on 4,640 hectares of land. The area under tomato crop was almost 50 per cent to the total cropped area under vegetables and the area mainly falls in Kandaghat and Solan blocks. In irrigated areas, tomato is grown during the summer season while in rain-fed areas it is cultivated during the rainy season. Nowadays tomato cultivation in this area is done by means of natural farming under Subhash Palekar *Prakritik Kheti Khushhal Kisan Yojana* introduced by the government. Although tomato cultivation is also done by conventional methods in this area.

Agricultural scientists are always trying the modern technique in agriculture. Modern farming techniques are causing excessive topsoil erosion due to which the production and productivity of crops are affected. Due to these techniques, the areas are converting into deserts and the groundwater level is also in an alarming condition. While the quantity of food production may have gone up as a result of the Green Revolution, the quality has gone down. Recent medical research has directly traced several human health

problems to the use of pesticides, particularly in tropical countries like India, Bangladesh etc. Climate change, deforestation, irrigational facilities and soil degradations are the major concerns that are connected with agriculture. To overcome these problems an attempt has been made to promote and study natural farming in village Mahog of district Solan of Himachal Pradesh with special reference to tomato cultivation.

2. THE STUDY AREA

Solan is one of the mountainous districts of Himachal Pradesh which came into existence on 1st September 1972 and it comprises of five Community Development Blocks namely, Kunihar, Nalagrah, Dharampur, Kandaghat, and Solan. Village Mahog comes under the Kandaghat community development block and the village is having an area of 0.37 sq. km. with a population of 84 persons and the number of households are 17 as per 2011 census. The female population of this village is 46.40 per cent to the total population of the village while it is 53.60 per cent in case of male population. The total literacy rate is 81 per cent to the total population of the village and in case of the female literacy rate, it is 36.90 per cent. The working population is 32.10 per cent to the total population of the village and they are mainly involved in agricultural activities. Mahog village is situated at an altitude of 1,680 metres from the sea level and it is near to Chail forest area. The nearest town to this village is Solan, which is connected by *pakka* road. The area under permanent pastures and the grazing land, and the net sown area, comprises of 70.27 per cent and 24.32 per cent to the total area of the village respectively. Mahog village experiences a sub-tropical climate. The village experiences mean maximum and mean minimum temperatures that ranges from 32.2°C in May to 0.6°C in January respectively. Both the rainy and the winter seasons have rain. The snowfall is received during the months of January and February. Despite the village's hilly topography, the agro-climatic conditions offer a variety of opportunities for growing cash crops, including temperate fruits, off-season vegetables, tomatoes, potatoes, and pulses in addition to cereals, millets, and oil-seeds. Wheat, maize, and rice are the primary cereal crops grown in this village.

3. OBJECTIVES

The major objectives of the present study are as follows:

- a. To highlight the various agricultural operations or activities per unit of area under tomato cultivation under natural farming in village Mahog of district Solan.
- b. To promote natural farming in village Mahog of district Solan.

4. RESEARCH DESIGN AND METHODOLOGY

The present study is primarily based on primary data, but for the geographical background of village Mahog regarding the physical, and socio-economic aspects, secondary data are also used and they are collected from various official sources such as Encyclopedia of Himachal Pradesh; District Census Handbook, Solan, 2011; District Statistical Abstract, District Solan, 2017-18; District Solan at a Glance, 2017-18; Block Development Indicator, District Solan, 2017-18; Economic Survey of Himachal Pradesh, 2017-18, 2018-19 and 2019-20; Statistical Year Book of Himachal Pradesh, 2018-19; and Annual Action Plan of Himachal Pradesh, 2018-19.

The present study deals with tomato cultivation under natural farming in village Mahog of district Solan of Himachal Pradesh. Village Mahog which falls under the Kandaghat community development block is selected as a study area because this village is dominant in tomato cultivation in district Solan as well as the climatic conditions and the soil is favourable for its growth. Most of the farmers in this village are cultivating tomatoes by conventional method but with the introduction of Subhash Palekar *Prakritik Kheti Khushhal Kisan Yojana*, the farmers are shifting towards natural farming. Most of the farmers have taken training in this regard under this *Yojna* (scheme) and they are practising the growing of tomatoes in this village. The primary data regarding various agricultural operations or activities like nursery bed preparation, land preparation and transplantation, mulching to control weeds and moisture, intercropping, staking, irrigation, liquid and dry *khad* (manure), harvesting, and production and marketing of tomato under natural farming is collected from the farmers of village Mahog through structured interview method in 2020. Data related to socio-economic aspects of the village are mainly represented by per cent method.

5. RESULTS AND DISCUSSION

5.1. Various Agricultural Operations in Tomato Cultivation under Natural farming

5.1.1. Nursery Bed Preparation

Tomato is a warm-season crop and the ideal temperature required for its proper growth ranges from 21°C to 24°C. Temperatures above 32°C adversely affect its growth as well as frost and high humidity also affect its growth. Tomato cultivation requires low to medium rainfall. Bright sunshine helps in developing its colour. Temperature below 10°C adversely affects the growth of tomato cultivation. Tomato cultivation under natural farming is mainly done in lower hilly regions.

To grow seedlings for field transplantation, *Desi* (indigenous) tomato seeds are sowed on nursery beds in the last week of January or the first week of February. Seeds are sown at a depth of about 2 cm and covered with a fine layer of soil followed by light watering by a water-can. To keep the beds at the proper temperature and moisture level, the beds should also be covered with dry straw or grass. Water-cans should be used to water plants as needed until germination is complete. Soon after the germination of seed, the dry straw which is used for mulching is removed. This plant will be ready for transplantation after 45 days from sowing in a nursery and at that time its height will be 2 or 3 inches. The *Desi* seed required for one *Bigha* of land will be 250 to 300 gm. Before the sowing of *Desi* seed in the nursery bed it is treated with *Bijamrita/Beejamrutha*. It is a treatment applied to seeds, seedlings, or any

other planting material, and it works effectively to shield young roots from fungus as well as against soil and seed-borne diseases that affect plants following monsoon. Local cow dung, a potent natural fungicide, cow urine, a potent anti-bacterial liquid, lime, and old soil make up *Bijamrita*. Any crop's seeds can be coated with *Bijamrita* by properly coating and mixing them by hand. Later, the seeds are dried well and further used for sowing.

5.1.2. Land Preparation and Transplantation

The land preparation in village Mahog is done by bullock pair but some farmers are also using mini tractors for ploughing. The bullock pair will take 5 hours to cultivate one *Bigha* of agricultural land while the mini tractor will take 3 hours to cultivate it. Generally, two ploughings are done to prepare the field. During the last ploughing of the field, *Jeevaamrita* is added in the soil to make it fertile. Levelling of the field should be done and later the furrows will be made at an interval of 1 foot. *Jivaamrita/Jeevamrutha* is a fermented microbial culture and it increases micro-organisms in the soil. The aerobic and anaerobic bacteria found in cow dung and urine grow during the 48-hour fermentation process as they consume organic ingredients (like pulse flour). *Jeevamrutha* is prepared by the formula: filling 200 litres of water in a barrel; add 10 kg fresh local cow dung and 5 to 10 litres of aged cow urine; add 2 kg of jaggery, 2 kg of pulse flour and a handful of old soil collected from the bund of the field. 200 litres of *Jeevamrutha* is plenty for an acre of land. Stir the mixture or solution and allow it to ferment for 48 hours in the shade. Twice a month, *Jeevamrutha* can be used in irrigation water for proper growth of crops. *Jeevamrutha* is applied for the first three years in the field and thereafter the field becomes self-sustain.

Tomato is transplanted in the month of March in this area and it is planted on a raised bed having a width of 60-75 cm. A distance of 60 cm is kept between two beds to perform various agricultural operations. The spacing between two plants should be 45 cm. To prevent the issue of waterlogging during periods of intense rainfall, raised beds are required. Tomato is transplanted in late afternoon in this area.

5.1.3. Mulching to Control Weeds and Moisture

Shallow cultivation is done at regular intervals to keep the field free from weeds as in the initial stage of plant growth it is necessary to remove the weeds as it decreases the yield of the crop. Farmers who don't use mulching must perform two to three hoeings as well as earthing up to protect the crop from weeds. Weeding is also done along with harvesting done from time to time. Weeds can be controlled successfully by *Jeevamrutha* (liquid *Khad*), *Ghan Jeevamrut* (dry *Khad*), and *Acchadana* or mulching. Basically, straw mulching is done for tomato cultivation in village Mahog which protects the topsoil from heating and retains soil moisture.

5.1.4. Intercropping

Crop production can be increased by adopting intercropping as well as it also increases the fertility of the soil. Intercropping controls the spread of weeds in the field, and by doing so the attacks of insects on the crops will be less as well as the farmer can get better results from his produce. Cropping systems rice-tomato, tomato-onion, and tomato-capsicum are popular in this village.

5.1.5. Staking

Staking is essential in tomato cultivation so that the plant would not bend and provide additional support to the stem and the tomato product. Staking facilitates help in the growth of plants and it also maintains the quality of the produce. It is done 2-3 weeks after transplantation. Staking can be carried out using bamboo stakes, wooden stakes, or overhead wires to which each plant is fastened.

5.1.6. Irrigation

Natural farming not only helps in improving soil quality but also requires less water for irrigation According to Subhash Palekar, the roots need water vapour (*Whapasa*) for their proper growth. Irrigation should be done at noon in furrows. The main sources of irrigation in this area are borewells and stream water. The stream water is stored in water tanks by the farmers and further this water is used for irrigation from time to time. After transplantation irrigation is required for 10 continuous days and afterwards with regular intervals. During the summer season irrigation is done by these sources but during rainfall, there is no need to irrigate the field, especially in the month of July when the rain starts. If the weather is cold then the requirement for irrigation is less because at that time the moisture contents in the environment are sufficient. The requirement of irrigation is less when the height of the plant is small while the amount of water increases with the increase of plant height. Light irrigation should be given after transplantation instead of giving heavy irrigation. During flowering and fruiting, water should not be given to this crop. During heavy rainfall, the furrows and bunds must be covered by straw and grass to protect the soil. The state government is also motivating the farmers for rain harvesting so that the deficiency of water for irrigation can be fulfilled mainly in the summer season.

5.1.7. Liquid and Dry *Khad* (Manure)

Around the root zone of the plants, all materials and nutrients needed for plant growth are available. There is no additional requirement for a plant from outside as the soil is prosperous-complete with nutrients. Only 1.5 to 2.0 per cent of the nutrients are taken up by the crop from the soil and the remaining 98 to 98.5 per cent come from the air, water, and solar energy.. *Jeevamrut* (liquid *Khad*) is used in the fields at regular intervals to increase the count of micro-organisms in the soil which increases its fertility and crop productivity. Various diseases in plant are also controlled by *Jeevamrut* (liquid *Khad*). *Ghan Jeevamrut*, a dry *Khad* is spread in the field after 3 days from the day of irrigation. It is spread in the field to increase the count of micro-organisms in the soil

and it also protects the plant from various diseases. It is also used in nursery beds as well as during ploughing by mixing it into the soil. *Ghan Jeevamrut* is prepared with 100 kg of local cow dung; 2 kg of jaggery (a local type of brown sugar); 2 kg of pulse flour; and a handful of soil from the bund of the farm. Mix all these ingredients with 5 litres of aged cow urine and let the mixture dry. This dry *Khad* can be stored for 6 months and per acre of land requires a total of 400 kg which is spread over the field at regular intervals. The plants are also protected from various diseases/pests/insects by applying *Agniastra* (liquid), and *Neemastra* (liquid) when needed.

5.1.8. Harvesting

To harvest tomatoes, one must twist their hands to detach it from the stem. Tomatoes are stored in shady places in baskets after harvest. The tomatoes are taken at regular intervals because they do not all ripen at the same time. Generally, the first picking of tomatoes starts in the first week of July and ends in September. When the tomato turns yellowish in colour just after the dark green shade it is harvested and later transported to market for sale. Three men are required for two hours per *Bigha* of land per harvest of *Desi* tomato.

5.1.9. Production and Marketing

Generally, the production of *Desi* tomato is 4,000 kg per *Bigha* of land. If the climatic conditions and other parameters are favourable for this crop then the production can rise upto 5,000 kg per *Bigha*. In the initial period of 2 or 3 years the production of tomato is low as well as the crop is prone to diseases while it increases after this period as the pH value of soil increases as well as the crop become disease-free. The farmers put their tomato production in crates to sell them in the market. One crate contains 25 kg of tomatoes. Most of the production is sent to Solan for sale by pickup vehicles (Mahindra Bolero). The farmers face difficulty in selling this product as there is no such separate *Mandi* (vegetable market). Only a small group of farmers trade their natural products in other cities, like Chandigarh, Ambala, etc. The price for their product fluctuates from time to time and nowadays people are buying this product as this is disease-free and is mainly used in Salad. This tomato can be preserved for more days as compared to tomatoes grown by conventional methods. The government is planning for its better marketing or selling by introducing *Mandis* in each block of the district as well as opening at least one shop for selling the naturally grown produce in every market yard of every district. Some awareness programs are also launched to tell the people about the benefits of natural farming and its products. There is a market at Solan for the sale of natural agricultural products grown by the farmers of this area.

6. CONCLUSION AND SUGGESTIONS

The present study highlights the way of cultivating tomato under natural farming through various agricultural operations or activities in village Mahog of district Solan. The Department of Agriculture of Himachal Pradesh has introduced Subhash Palekar *Prakritik Kheti Khushhal Kisan Yojana* to reduce the cost of farming and increase the farmer's income. Natural Farming is a holistic agriculture practice that counters commercial expenditure and market dependency of farmers for inputs and nothing has to be purchased from outside. *Beejamrutham* (coating of seeds by cow dung and urine) and *Jeevamrutham* (a concoction made of dung, urine, jaggery and pulse flour) plays a vital role in the growth of plants or crops under natural farming. There are great potentialities for growing tomato under natural farming in this area.

To promote natural farming in village Mahog of district Solan of Himachal Pradesh the following measures/suggestions should be adopted:

1. Officers/officials working at different levels should be trained in Subhash Palekar Natural Farming (SPNF) and should be deputed further for the implementation of the programme in their respective areas.
2. One Progressive farmer from village Mahog would be selected and will be trained in SPNF so that he can deliver the knowledge and training to other farmers of the village.
3. Initially, farmers may not put their 100 per cent land under SPNF, but may be convinced to practice SPNF in smaller units.
4. State and District Unit would organize *Kissan Goshthis* (Farmer's Conference) at district and block levels to educate farmers about natural farming. Respective State Agricultural Universities and *Krishi Vigyan Kendra* (Agriculture Science Centre) will also be associated in district and block-level programmes.
5. For purchase of Indigenous/ *Desi* cow subsidy of 50 per cent subject to a maximum of Rs.25,000 would be given to SPNF practising farmers as per the scheme of Animal Husbandry Department.
6. All farmers in the village may not have a local cow or are unable to rear it. The government should assist the farmers by providing them with a lump-sum amount of Rs.50,000 per farmer for the construction of a cow shade and purchase of other related materials.
7. An assistant of Rs.8,000 per family should be given to construct a pit to collect the urine of indigenous cow.
8. The government should provide plastic drums or an amount of Rs.750 per drum per family to facilitate on-farm input (liquid *khad*) generation.

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