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Ensuring Food Safety in Grapes Through Good Agricultural Practices in Tamilnadu

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Abstract
The changing pattern of food consumption some life taking food borne diseases have emerged since last few years and consumers are increasingly conscious about the food safety and health issues. To address the issue of food safety, agriculturists and policy makers of different countries have taken up certain measures to ensure sanitation of agricultural produce right from the farm to the table. Good Agricultural Practices (GAP) is one of these standards developed by the Food and Agriculture Organization (FAO) and presently GAP certification is a must for export in most of the developed countries. GAP aims at attaining social, economic and environmental sustainability by following certain criteria right from the planting of crop to the marketing. India with more than 28.2 million tonnes of fruits is the 2nd largest producer of fruits in the world. India has the distinction of achieving the highest productivity in grapes in the world, with an average yield of 30 t/ha. More than 80 per cent of the total production is consumed as table grapes in India. Well maintained and established grapes orchards bring better returns per unit area of land than many of the field crops. Approximately, 2.5 per cent (22,000 tonnes) of fresh grapes are exported to the Middle East and European countries through three different agencies viz., grower exporters, growers' cooperatives and the trader exporters. GAP is essential to meet the quality standards of these countries where grapes are exported in large quantity. Since table grapes are consumed fresh, food safety issues are even more relevant to it. Starting from presence of pathogens, pesticide residues to poor handling and packaging, everything can make the produce unacceptable for export.

Keywords: Socio-economic impact; climate change; technologies

Introduction

Grapes (Vitis vinifera) belonging to the Vitaceae family, originated in Western Asia and Europe. It was introduced to India by the Persian invaders in 1300 A. D. Grapes is a non-climacteric fruit that grows on the perennial and deciduous woody climbing vine. Grapes is a cross pollinated vine with simple, lobed, cut or toothed leaves (seldom compound) with racemes of greenish flowers, the fruit consisting of watery or fleshy pulp, stones and skin, four-seeded. Grapes can be eaten as fresh or used for making jam, juice, jelly, vinegar, wine, grape seed extracts and grape seed oil. Approximately 71% of world grape production is used for wine, 27% as fresh fruit, and 2% as dried fruit. However, in India, 90% of the

grape is used for table purpose, even though wine making has made strides. The rest of the grape is used mostly for raisin.

International scenario:

Grapes occupy a predominant position in terms of world fruit production, accounting for about 16% of the global fruit production. The total world production of grapes is estimated to be about 68.9 million tonnes, next only to citrus and bananas and is followed by apples. The major grape producing countries are Italy, France, Spain, U.S.A, Turkey, Argentina, Iran, Portugal, South Africa and Chile.

National Scenario:

The annual production of fresh grapes in India during the year 2006-2007 was to the tune of 16.67 lakh tonne from an area of 63600 ha. India ranks first in productivity (25.69 t/ ha) against the world productivity of 9.32 t/ha and also in terms of highest recorded yield of 100 t/ha. Cultivation of grapes in the country is very much localized, being confined primarily to four states , viz., Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu, which together account for more than 90 percent of the area and production.

Climate

The climatic factors such as temperature, occurrence of frost, rainfall and relative humidity play a vital role for commercial cultivation of grape. Generally grape requires a hot and dry climate. Regions with high rainfall and humidity are not conducive for grape cultivation. Hence the coastal districts of the state are not suitable for grape production. Grape is successfully grown in regions of Maharashtra with a temperature range of 150C to 400C and rainfall of 50 to 60 cm. The weather should be clear for about 3-4 months during the cropping period. Cloudy weather, high humidity low temperature and rain during flowering and berry development are detrimental as they promote spread of diseases.

Soil

Although grape can adapt to a variety of soils, it grows and performs best in deep mediumtextured soils (loams and sandy loams) with good drainage and low salt content. Salinity is the major hindrance in the development of grapes. It grows well in soils with a pH range of 6.5 to 7.5.

Propagation

Development of salt resistant rootstocks like Dogridge and Salt Creek has given an impetus for area expansion under grape in saline areas. Most of the new vineyards are established on Dogridge rootstocks in the state of Maharashtra. The rootstocks are supplied by NRC Grapes, Maharashtra Grape Growers' Association etc. Some of the progressive farmers produce rootstocks for their own use and sale. The mother plants are available with NRC Grapes and farmers' field. The rootstocks are raised by planting hard wood cuttings on flat beds at desired spacing, depending upon the variety and method of training.

Varieties

The main varieties grown under organic cultivation in the state are Thompson Seedless, Sharad Seedless and Tas-A-Ganesh.

Spacing

Spacing varies with variety and soil fertility. Generally under organic cultivation, spacing of 2.5 m x 1.5 m, 2.75 m x 1.50 m and 3.0 m x 1.5 m are followed. For this model scheme, a spacing of 2.75 m x 1.50 m with a plant population of 2425 plants/ha is considered.

Land preparation

The land is prepared by ploughing it twice and harrowing it thrice.

Planting

Pits of 90 cm x 90 cm x 90 cm are dug and filled with soil and well decomposed FYM/Compost @ 55 t/ha. The pits are then irrigated in order to allow the soil to settle. Rectangular system of planting is adopted for growing grape.

Training

Training is an important operation in grapes. It helps to maintain the stature and spread of the vine and facilitates operations like pruning, intercultivation, spraying and harvesting. There are many systems of training. The common systems in India are Bower, Kniffin, Telephone, Trellis and Head system. Under the climatic conditions of Maharashtra, Bower and Trellis system has been found to be the best for commercial varieties like Thompson seedless, Sharad Seedless and Tas-A-Ganesh. In Bower system, a bower of 2.1 m height is erected using stone pillars as support and galvanized iron wire of 8 and 10 guage thickness for mesh. One vigorous growing shoot is selected by nipping off other shoots and this single shoot is allowed to grow up straight with the support of bamboo or plastic wire stake.

All the axillary shoots are pruned and the main growing shoot pinched off at 15 cm, below the pandal level. Two shoots arising below the cut area are allowed to grow in opposite direction on the wires overhead. These two shoots develop into main arms. On the main arms, side shoots are allowed to grow at regular intervals of 40 to 45 cm. These side shoots are called secondary's and tertiaries or canes from which fruiting spurs develop. The arms and secondary's form the permanent frame work of the vine.

The main arm should be trained towards East and West direction so as to reduce damage due to sunburn during summer months especially after February-March pruning. The entire space allocated for each vine is covered in a gradual manner by intermittent pinching of the primary arms and secondary's, not allowing them to grow more than 60 cm at a time. As they grow, the shoots are tied with jute twine and all tendrils are removed.

Pruning

Removal of any vegetative part in a vine is called pruning. It is a critical operation in grape cultivation. Therefore much care and precision needs to be exercised in pruning a vine. The main objective of pruning grapevine is to increase productivity, facilitate intercultural operations and maintain desired vine framework and vitality of the vine for consistent productivity. In organic grape cultivation, the vines are forced to undergo rest for about a month immediately after harvest.

This helps in storing the food material in the mature parts of the vine. The canes are cut back in April by keeping 1-2 buds which develop into canes in 4-5 months. The removal of dried canes is called 'back pruning' or 'growth pruning'. In the month of September-October these canes are pruned for fruiting.

This pruning is called 'forward pruning' or 'winter pruning'. Vines, which have attained the age of one year can be subjected to this pruning.

Manuring

Manuring is done by applying FYM at the rate of 55 t/ha. Bio fertilizers like Azatobacter, Phosphate Solubilizing Bacteria(PSB), Effective Microorganism (EM), Neem cake and vermiwash are being used to supplement the nutrient requirement of crop.

Trichoderma, Azatobacter and PSB are applied at the rate of 25 g/plant. Neem cake is applied at the rate of 1.25 t/ha. Jeevamrut is prepared by adding 10 kg cow dung, 5 l cow urine, 2 kg black jaggery, 2 kg ground pulses powder, handful of bund soil in 200 l of water. The solution is kept for 2 to 7 days in shade for fermentation. During the fermentation, the solution is stirred daily. To improve the quality of grapes, a solution of sugar, humic acid and coconut water is sprayed at bud development stage.

Irrigation

A fully grown vine requires about 1000 l of water in winter and 2000 l in summer season immediately after pruning and application of fertilizer. Vines are given 2 to 3 summer irrigation at 3-4 days interval. During winter, an interval of 8-10 days is maintained between two irrigation. The vines are to be irrigated when the top 5 cm soil is dry in winter and 3.5 cm top soil is dry in summer. During berry development stage irrigations are given at weekly intervals and the same is withheld 10 days before harvesting to improve quality.

The world scenario of agriculture is changing rapidly and to maintain a pace with it, new concepts are to be adopted immediately. Indian farming needs to be commercialized in order to maximise farm income and for that we need to meet quality standards and demands in the national and international market. Along with globalization, dramatically changing economy, new inventions in food science and technology and changing pattern of food consumptions, some new contaminants, toxins and additives, physical, chemical and biological hazards have also emerged resulting in huge health risk of the consumer. In 2011-12, nearly 3000 people from 16 countries fell sick due to e coli outbreak of contaminated cucumber (Das, 2013).

According to one of the reports of World Health Organization (WHO) 11 per cent of all food sold in India are adulterated. Along with the specific diseases like Lathyrism, Epidemic Dropsy some general diseases like heart diseases, diabetes, gastritis, hypertension and even anxiety and depression are found to be correlated with low quality and even poisonous food consumed by millions of people every day. Considering these facts, Food and Agriculture Organization (FAO) and World Health Organization (WHO) came up with certain quality standards, which are a decade old now. Indian farmers and as well as the stakeholders are yet to be familiar with these measures and standards that can help them gain consumer trust and reputation in international market and also to avoid the non -tariff barriers set by World Trade Organization (WTO). FAO and WHO always encourage the countries worldwide to harmonize their standards with those of CODEX Alimentarius Commission (CAC).

To set a common understanding about the standards, FAO came up with certain globally accepted control and compliance systems and standards for measures of food safety like Good Agricultural Practices (GAP), Traceability etc.

What is GAP?

According to FAO (2003), Good Agricultural Practices (GAP) are the practices that address environmental, economic and social sustainability for on farm processes and result in safe and quality food and non-food agricultural products. GAP can be said as a control and compliance system with four major pillars namely economic viability, environmental sustainability, social acceptability and food safety & quality.

Objectives of GAP are –

1. Ensuring food safety,
2. Capturing new market,
3. Judicious use of natural resources,
4. Maintaining worker health and welfare,
5. Income generation,
6. Enhancing international trade,
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8. Risk assessment
9. Building consumer confidence.

There are certain critical parameters like traceability, record keeping, site history, soil management, fertilizer use, irrigation, crop protection, harvesting, produce handling, waste and pollution management, health and welfare of worker and environmental issues based on which the standardization agencies declare a GAP certificate to one or a group of producers. But the major challenge in Indian context at present is creating awareness about GAP among the farmers, stakeholders and also the retailers. The compliance with food safety practices applicable at the farm level is not very encouraging. The adoption intensity of food safety practices varied from 0.42 in Bihar to 0.57 in Punjab. This implies that farmers are adopting only 42 to 57% of the food safety measures at the farm level (Kumar et al., 2011). While WTO poses some challenges, it also offers tremendous opportunities for Indian agricultural producers and to explore it educating the stake holders as per the requirement is a must.

Relevance of GAP in Horticultural crops

India with diverse soil and climate comprising several agro-ecological regions provides ample opportunity to grow a variety of horticulture crops. Though these crops occupy hardly 7 per cent of the cropped area, they contribute over 18 per cent to the gross agricultural output in the country. India with more than 28.2 million tonnes of fruits is the 2nd largest producer of fruits in the world. Well maintained and established grapes orchards bring better returns than many of the field crops. From a unit area of land more yield/ income is realized than any of the agronomic crops.

Grapes (Vitis sp.) cultivation is one of the most remunerative farming enterprises in India. India has the distinction of achieving the highest productivity in grapes in the world, with an average yield of 30 t/ha. More than 80 per cent of the total production is consumed as table grapes in India. Approximately, 2.5 per cent (22,000 tonnes) of fresh grapes are exported to the Middle East and European countries. The rest of the produce is marketed within the country. Grapes are exported through three different agencies viz., grower exporters, growers' cooperatives and trader exporters. GAP is essential to meet the quality standards of these countries where a grape is exported in large quantity. GAP certification can further

upgrade the value of the produce in urban market, especially among the high society customers and can help the growers to fetch remarkably higher price. Grapes being highly commercially important crop can further be exploited to fetch more foreign exchange in the country.

Importance of GAP for grapes

At present, the area under grapes cultivation in India is 111000 ha (NHB stat 2011) with the production of 1235000 tonnes. Table grapes cultivation is mostly concentrated in peninsular India like Maharashtra and Tamil Nadu with Maharashtra being the largest producer (75.33 per cent). Grapes is the highest among all the fruit crops to earn foreign exchange and is also creating employment opportunities for farmers, farm labourers, exporters, traders and others who are associated with it. Following the criteria of GAP can further help the stakeholders to attain international standard and thus to explore more opportunity for export and eventually to upgrade their economic status. GAP in terms of training, pruning, vineyard management, irrigation, fertilization, crop protection, appropriate stage of harvesting, method of harvesting, packaging, storing and transporting are important and these practices also ensure the safety of the produce. Grapes growers of India are highly dedicated and committed group and it's their own effort that has made the Indian grapes cultivation to establish a position in the world grapes trade. Now the time has come that not only the elite group of farmers but also the small and marginal unorganized farmers need to be aware of GAP. The Inter-Ministerial Task Force on Agricultural Marketing Reforms in their report in May, 2002, suggested several measures for undertaking various reforms in the Agricultural Marketing System in the country. In view of the keen competition in the domestic as well as international markets, it has become imperative to launch awareness programmes vigorously to up-date the technical know-how of various stakeholders involved in the marketing of farm produce in multi-dimensional aspects of agricultural marketing system.

How to Create Awareness about Gap

GAP is comparatively a new concept and even a newer one in context of Indian agriculture. It is obvious that the change which is being talked about regarding farm practices will not take place over night. Appropriate ways of disseminating information, communicating farmers and mostly educating them about GAP and its importance are to be thought of. Along with the traditional methods of communication a number of innovative teaching methods are now under discussion.

At present we require some media which can reach maximum number of farmers in the shortest duration without losing the specificity and for this we have to supplement our traditional extension methods with modern ideas and teaching aids. These aids if effectively used can bring phenomenal change in the awareness level of stakeholders about GAP and thus eventually lead to high rate of adoption of food safety measures and safe cultivation practices. One such innovative communication and teaching method will be discussed here that is e-learning, a tool of Information and Communication Technology.

ICT and e-learning

Information and Communication technology includes everything ranging from radio to satellite imagery to mobile phones or electronic money transfer. It is a set of technological tools to create, disseminate, communicate, store and manage information. Information is the biggest strength of

human being which leads to knowledge generation and knowledge management. A well informed person is always a step ahead to handle any kind of situation with a readiness and preparedness, so providing right information at place is a must to enhance the socio economic status of the Indian farmers and thus can brighten the face of Indian agriculture. ICT combines the advantages of both the traditional face to face communication and mass media. But it is to be kept in mind that ICT is not a replacement but is a supplement to the traditional extension methods.

Ensuring Food Safety in Grapes through Good Agricultural Practices 183 One of the recent inventions of ICT is e-learning that is the use of electronic media and technology in education. E-learning is broadly inclusive of all forms of educational technology in learning and teaching. E-learning includes numerous types of media that deliver text, audio, images, animation, and streaming video, and includes technology applications and processes such as audio or video tape, satellite TV, CD-ROM, and computer-based learning, as well as local intranet/extranet and web-based learning.

E-learning got momentum with the invention of World Wide Web in the 1990's. Though to a lesser extent e-learning has made its way in India also. Today a number of learning modules are available on market from kindergarten to university level but using e-learning to educate Indian farmers is a brand new concept. E learning is based on the humanistic philosophy of education that gives highest priority to learner and aims at active participation of learner. Learner centered education prioritizes needs of learner, their cognitive level, unique learning styles, problems and past experiences. Merging this humanistic and reflective concept of education with Information & Communication Technology (ICT), a new method of interactive learning has emerged namely e- learning.

With all these above mentioned advantages e-learning can successfully be utilized for educating farming community or those who are directly or indirectly related with agriculture. Not only the farmers but the researchers, agricultural students and scientists, extension professionals also require to be updated on regular basis about new technologies and ideas and this can be done through e-learning. E-learning modules can meet this need by providing information relevant to farming in a capsule form over a large geographic area saving time and cost.

Designing E-Learning Module on Gap for Grapes

The importance of awareness about GAP for the grapes growers of India has been mentioned above already. At present the situation demands a methodology that will effectively educate the stakeholders about GAP principles, criteria, pre-harvest and post-harvest safety measures in shortest possible time. For this designing an e learning module on GAP for grapes is thought to be an innovative measure.

The probable target clientele of the module are grapes growers, exporters, traders and also KVK scientists and line department staff. The module will attempt to provide information on GAP for grapes and its importance in international market in a nutshell. Guidelines regarding different criteria of GAP and food safety standards are to be provided. Guidance regarding selection of suitable table grapes varieties, level of chemical use, vineyard management, and process of harvesting, post-harvest operations in compliance with food safety standards are to be provided. Attempt is to be taken to make the module interactive, interesting to learner with provision of direct feedback keeping in mind the need of adult learner.

Conclusion

The wide range of geographic and climatic variation, seasonality, presence of a number of cultural and ethnic groups with different languages make Indian agriculture remarkably diverse and challenging but at the same time there is ample opportunity to make use of the vast natural and human resources this country has naturally. Post-independence policy makers of India concentrated mostly on production enhancement and after the success of green revolution production is no more the problem of Indian agriculture. Now the challenge lies in integration and utilization of resources we already have. The time has gone when only two times bread and shelter were thought to be enough for Indian farmers. It is high time that Indian farming is to be exposed to the international scenario so that it can maintain a pace with the world food trade and for this the fast and foremost requirement is educating our farmers about the international standards and demands. To educate the farmers the extension professionals also need to be up to date and well informed. Keeping in mind all these needs, the idea of designing an e-learning module has been discussed thoroughly in this paper with its focus on a recent issue like GAP for grapes which is at present a very much commercially important crop in India.

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