

CITRUS PRODUCTION IN PAKISTAN

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Nutritional importance

In Pakistan, 75% of the total daily food (with respect to calories units) is derived from the plant source. However, our people do not give due importance to the proper amount of essential vitamins and minerals in their diet. Resultantly their level of body growth remains underdeveloped when compared with the individuals of other developed countries. The people of advanced countries take the essential components of diet from milk, butter, meat and eggs. Most of our society members can not afford to meet their basic food components from the aforementioned food items because of scarcity and above all out of reach of most of the people. Nevertheless, nature has blessed to Pakistan the abundant quantities and qualities of fruits and vegetables to compensate the deficiency of food items, essential in the diet of our people. For this purpose, citrus fruits play a vital role and their chemical analyses have revealed that all other fruits are rich source of a number of essential components of diet. The composition of citrus indicates that its fresh fruits contain high quantity of vitamin C in addition to vitamin A and B. The presence of Vitamin C in the human body keeps the teeth and gums healthy by protecting them from bleeding. Vitamin C also regulate the thyroid gland to slash the throat from the sore and also assists in maintaining the blood mechanism in a health way. The lack of vitamin C may cause pains to the

joints of the bones. Citrus fruits also contain the essential minerals like calcium, phosphorus, iron, zinc etc, alongwith protein, fats, carbohydrates, which are recorded very important for human health as they take part in various metabolic activities of the body. Table 1 shows the composition of some citrus fruits.

Cultivation suitability

This fruit is assumed to be appeared first time in the Assam and China's highlands and received an esteemed attention on reaching Indo-Pak. Citrus cultivation in Pakistan is adhered with the creation of Pakistan. However, its commercial importance was virtually recognized in seventies when farmers changed their trend of farming in view of excellent adoptability of soil and climate for citrus production. Consequently, they accepted citrus as a premier fruit for getting handsome profit to increase their socioeconomic condition. Citrus plants can be cultivated in the climate from subtropical to tropical having the altitude up to about 800 meters from the sea level. Generally citrus thrives optimum in the temperature as minimum as -2°C and as high as 43°C .

For the best cultivation of citrus plants, fertile and loamy soils in a slight presence of lime, possessing the pH value of 5.6, are considered the most suitable. However, too heavy soils and/or the soils containing excessive sand/salts, pebbles etc. are not

recommended for their successful cultivation. Proper frequency of irrigation is a vital factor for the successful growth of plant during its entire span of life. Therefore, only those areas are fit for citrus cultivation where abundant supply of irrigation could be managed without noticeable shortfall. In the areas which are good for citrus cultivation but having scarce sources of irrigation, the farmers should encourage to adopt the system of sprinkler or drip irrigation. Both these irrigational systems have excellently benefited a number of countries in place of flood irrigation or basin system, where heavy loss of water is taken up and which can not be afforded in the light of present scenario of total rainfall shortage.

The prospects of having good crops of citrus fruit were found feasible in areas with hot and humid temperature, with modest rainfall and little frost at night. Fortunately, the province of Punjab, particularly its central zone is considered to be the most congenial place with regard to the suitability of soil and climate for the cultivation of citrus fruit of all kinds. The central districts are contributing a significant part in citrus production, to boost up the citrus industry in Pakistan, yet, there is sufficient room for its further improvement by establishing the new orchards in these areas with the cooperation of private and public sectors. The areas like Gujrat, Gujranwala, Okara, Sargodha, Faisalabad, Sahiwal, Multan, Khanewal, Toba Take Sing (TSS) are the worth mentioning districts of Punjab for citrus cultivation, particularly for the production of kinnow and oranges. As a matter of fact, over 95% of the total production of citrus fruit takes place in the Punjab and only 5% in the Sindh and

NWFP and only negligible production is in Balochistan. There is a concentration of kinnow orchards in Sargodha, Gujrat, Faisalabad and Gujranwala districts of Punjab and the rest in Okara and Sahiwal districts. Some varieties of citrus can show excellent performance of growth and development even under low sub-tropical to temperate region. For an instance the variety of orange, '*Blood red*' can not develop red colouration in the fruit segments until a considerable cold prevails in the growing area.

An Overview of Area and Production in the Past and Present

Substantial improvement, both in the area and output of citrus fruits, can be attributed to the keen interest shown by the growers on one hand and incentives given by the government to export the citrus fruits. This trend led not only to earn the foreign exchange for the country but also increased the social status of the growers.

Peeping into the window of the past, till early sixties, both the area and production of citrus in the country was negligible. The breakthrough in citrus was achieved after the introduction of kinnow during that period. The area under citrus was around 45 thousand hectares and the production was around 425 thousand tones, in sixties. However, sharp increase was recorded both in area as well as production of citrus after a short while, when the annual average area stood at around 75 thousand hectares and average output went up to 722.2 thousand tonnes in the era of seventies. This increase further pushed up to 123.5 thousands hectares with 1201 thousand tonnes respectively in mid eighties. The increase in area and production of citrus during this period was the result of special efforts by the growers as it led to appreciable increase

in their income. Encouraged by this trend, efforts were intensified by the experienced farmers and many farmers also entered in the field on the other who started growing citrus fruits in their land either by adopting conventional old system or by adopting double cropping pattern (which implies that in the same field crops and fruit were cultivated). This practically helped in raising both acreage as well as production. The data tabulated in Table 2 and 3 indicate the gradual increase in area and production of citrus in Pakistan from 1980 to 2001. It is worth to mention that kinnow occupies about 60% in the over all citrus production of Pakistan, with particular reference to the Punjab. Progressive farmers prefer to grow kinnow because of its high yielding characteristic and also its fruit is of attractive quality that possesses the potential to give lucrative return (profit).

Trends in the Production of Citrus in Pakistan

Citrus has varieties of fruits, but oranges (Malta), mandarins, grapefruit, sweet lime and lemon are the salient fruits of their kind with regard to production and consumption. In Pakistan, this fruit mainly consists of kinno and some oranges (Malta), although more kinds like lemons, Feutrells Early and other oranges are also being produced. A new trend of high production of Feutrells Early has been observed in the recent years that reduced its price to a greater extent. At the time of independence, small quantities of oranges and lemons in citrus fruits were used to be produced, yet kinnow was ranked the main variety of citrus that came in the limelight during the early sixties. This variety became very popular in the country both because of its taste and production. The

sugar:acid ratio of a fully ripped kinno is matchless over other citrus fruits. Many research institutes contributed significantly in improving the physical and chemical characteristics of kinnow. It is heard that efforts are being made to develop seedless kinnow or a kinno fruit with minimum seeds (less seeded kinnow). If seedless kinnow introduces in the market by the citrus experts, it will be an excellent achievement in the history of citrus cultivation. Europeans and Americans generally do not prefer to consume fresh kinnow because of discouraging social trend of frequent seed spitting.

Citrus can be divided into the following groups:

Oranges: Musammbi, Pine-apple, Jafa, Hamlin, Blood red, Velencia late, Washington navel, Rubby red

Mandarins: Feutrells Early, Kinnow

Grapefruit: Marsh seedless, Foster, Duncun

Lemon: Eureka lemon, Lisbon

Over the years, many new varieties of citrus fruit were introduced. The weight and size of kinnow and other varieties are much heavier and bigger than the earlier varieties. The research centers of agriculture and their allies in Pakistan are engaged in evolving new and better varieties which give higher output and are pest and disease resistant. In fact, many new varieties are suitable for cultivation where these are most suited and as such each variety is recommended for specific area where it can give best results. This is really a big contribution of the research institutes by dint of their constant efforts to introduce new varieties and replace the old ones. Recently, the new introduction of few citrus varieties for general cultivation has increased fruit production in the country manifold.

Mode of Propagation

Citrus plant can be propagated in a variety of ways. Its rootstocks are generally grown by seeds, by mean of sexual reproduction. However, the seedlings developed through this method are highly heterozygous (not true to type). The other way of citrus plant multiplication is the vegetative (asexual) mode of production. Cutting is one of the effective method that can produce the plants alike to their mother characteristics. For example, sweet lime can be reproduced and multiplied by cutting. All kinds of citrus, however, are not at par to accept this method. Therefore, budding and grafting practices are adopted to get comparatively more reliable citrus planting material, ignoring some exceptions. For this purpose, availability of reliable rootstock and scion material are the prerequisites to bring citrus production to a success. Needless to say, a successful budding or grafting requires the right selection of rootstock, which is an over emphasized demand. Now a days, tissue culture and other important biotechnological methods are being employed for the quality production of citrus in many countries of the world.

The results of different experiments have proved that rootstocks not only influence the growth and yield potential of fruits but also contributes in determining the taste, flavor, quantity of vitamins etc., in addition to the age of the plant and the resistance against pests and diseases. Some of the important rootstocks for citrus cultivation are mentioned here:

Jati-khati: This rootstock is compatible to almost all the citrus fruits, particularly for the orange variety '*Blood red*'. The plants grafted onto this rootstock can bear the condition of

dryness to a great extent. However, the performance of this rootstock remains very poor when grown in the wet and heavy soils.

Kharna-khata: The plant of this rootstock resembles closely *Jati-khati*, which is very much compatible for the growth of *Valenciolate orange* and grapefruit, but quite unsuitable for *Blood red* and *Jafa* oranges.

Khata: This rootstock flourishes well in the heavy wet soils, thus, very much successful in the province of NWFP. Although the growth of the grafted plants is relatively slower, yet the fruits so produced are good in quality.

Jambheri: The plant of this rootstock resembles with *Jati-khati* and some times is used as its alternative.

Gada-dehi: This rootstock was imported from Ceylon and is suitable for kinnow grafting.

Export of Citrus Fruits

In Pakistan, as a matter of fact, of the total export of agricultural commodities, about 4.0% comes from the export of fruits. Of this, bulk of the export is contributed by citrus fruit. Statistics has indicated that in the year 2000-2001, Pakistan exported the total fruits quantity of 259.9 thousands tonnes to different countries earning Rs. 4575.0 millions of foreign exchange for Pakistan Citrus, particularly the kinnow, has contributed its lion share to improve the economical condition of the country. There is a vast scope for export of citrus to many countries. The countries including Iran, Oman, Kuwait, Saudi Arabia, Thailand, Malaysia, and Indonesia are importing citrus from Pakistan in large quantities.

The demand of citrus fruits in different countries of the world is gradually increasing. It is appreciable to mention that Pakistani growers in no

way compromise in producing the export quality of citrus fruits. Kinnow and Feutrells Early are highly accepted by the people in Asia and Gulf countries. Above to all citrus fruits, Kinnow has comparatively longer shelf life (post harvest life) and its general mouth acceptance (organoleptically) by the Arabian people is known to be extremely high. Due to these two factors, citrus growers in the province of Punjab prefer to produce export quality kinnow in their orchards and Sargodha and its surrounding areas are famous for the cultivation of kinnow. The gulf countries have shown their special interest for the regular supply of good and export quality of kinnow due to high demand on the part of their people. Pakistani kinnow is eaten up with great relish in many of the Arabian countries.

We must applaud to those agricultural scientists who are hectically engaged in exploring the best varieties of citrus in the context of quality and yield. Similarly increase of juice contents, betterment of aroma and flavor, balancing of sugar/acid ratio, development of seedless fruits, and introduction of plants possessing the characteristics of pest and disease resistance, with the feature of early bearing, are the frontier challenges for the researchers involved in citrus research laboratories. And indeed, by dint of their restless efforts, and also with the serious involvement of the citrus growers in the practical application of modern technology in citrus cultivation, a sufficient bright scope for raising citrus output would come into reality. Many new areas can be explored for this purpose as well as new techniques can be applied on the old and established orchard of citrus.

Need to Establish a Citrus Institute with Modern Facilities of Biotechnology

Pakistan is lag behind in industrial sector and thus relies on the agricultural economy. In the past, government merely claimed to give due importance for spending a targeted amount on scientific research. However, the present government took bold steps and increased the budget to manifold for S & T as an investment for the future prosperity of the country. The "COM STECH" organization was constituted by the special interest of the President of Pakistan with the leading role to boost the scientific activities of the Muslim world with the best utilization of their valuable resources.

The dynamics of scientific know-how is rapidly changing. The wave of globalization is gaining momentum. Biologists want to collect all the information they can be of every gene in every genome and from that information construct models of how genes work together and maintain a living body. In the modern century, Biotechnology has given broad spectrum of revolution to absorb new concepts and to pace with these changes and particularly to take advantages of it. Biotechnology is one of the latest components of biology that underscores modern molecular life science research. The practical applications of Biotechnology are being employed in almost all the areas of interest mainly in the improvement of agriculture. Over the last 20 years, it has turned out that the introduction of Biotechnology developed a speedy competition in research and consequently benefited the economical conditions of a number of countries around the world. The other positive aspect of this technology is that it helps a

lot in solving the practical problems of production. The potential of economic resources are very much lucrative by means of growing bio-products through Biotechnology. The introduction of Biotechnology in Pakistan at different level could definitely attribute the highly perspective for raising the future column of the country, thus contributing the socio-economic level of our people.

Biotechnology for commercial purpose was commonly introduced three decades earlier. Since then commercial plant production by using biotechnology has evolved into a competitive worldwide industry that produces 250 million plants annually. More recently, micro-propagation in the crop production has become increasingly important because the biotechnological activities strive to fill new markets. In other words, biotechnology is being used as a paramount tool of agriculture in public and private sectors which has contributed a lot in dealing with agricultural productivity. *National Institute of Biotechnology and Genetic Engineering (NIBGE)* in Faisalabad and *National Centre of Excellence in Molecular Biology (NCEMB)* in Lahore and few others of the same sort are engaged in solving different issues of crops improvement by the application of Biotechnology. It is quite imperative to establish an institute of citrus with a broad set up of biotechnology laboratory, where all kinds of research activities must be undertaken pertinent to citrus and its allies. And undoubtedly, the initiative of such institute will profess a new directionality in the area of citrus industry to boost up horticulture in Pakistan. The suggested tentative location of the proposed institute should be in view of the need of all strategic citrus growing areas and which can be

referred as the central source of connection for various citrus zones in Pakistan to coup the essentialities of integration amid scientists and citrus growers. It is hoped that the concerned high-ups will put ear on this proposal in the vital interest of the country.

Some More Suggestions for Improvement

- In Pakistan a lot of reliable sources are available in the form of nurseries of true-to-type citrus seedlings and at the same time identified and best quality citrus plant materials can be selected from the well established orchards located in the different areas

- If proper grading and processing is done, the value of export of citrus fruit is bound to increase. Efforts are therefore, required to produce quality products which can be done by inviting private sectors in this regard

- In the field of research, private sector must be encouraged to participate in setting up research institutes/organizations in citrus growing areas. Technical know-how can be obtained from the established agricultural research institutes.

- A continuous endeavor made by the scientists/researchers is highly required to evolve new hybrid varieties of citrus. Parallel to these efforts, some more promising exotic varieties of citrus should be introduced for their adoptability in different climatic conditions of Pakistan, to raise the business in citrus industry. A report had indicated that in the past, hundreds of several varieties of citrus were brought in Pakistan for research on various aspects and subsequently to disseminate amongst the farmer community. The results to introduce these exotic materials were claimed to be much encouraging but the benefits that would

have approached to the relevant farmers appeared with low or no significance.

- In Pakistan different institutes/organizations of the sorts like fruit development boards, fruit cooperative societies, fruit export associations, organizations for grading and processing of horticultural crops, private and public nurseries and orchards, research institutes, and agricultural universities with their affiliated colleges etc., are performing according to their capacities. However, the strong bond of interaction and beneficial cross communication of all the above cited organizations need a thorough evaluation of restructuring for obtaining better outcome in the area of citrus and its related industry.

- The major reason lies behind is that the business of exporting citrus to other countries is a value-added and highly profitable enterprise which is

chiefly based on the trustfulness of the produce being exported to the committed countries. The past ugly precedents are on the record that some greedy and selfish businessmen involved in citrus export sent the consignments that reached the destinations with substandard appearance of the produce. This shocked the country's goodness as well as the graph of bilateral dealing dropped considerably. Such dirty and nefarious practices must be slashed at official as well as private level and be backed up by the devoted, sincere and dedicated citrus growers and their related community.

Table 1: Chemical composition of some citrus fruits (in 100 g of edible part)

Serial No.	Component	Grape fruit	Lemon	Orange
1	Calories (units)	44	44	50
2	Water (g)	88.8	89.3	87.2
3	Protein (g)	0.5	0.9	0.9
4	Fats (g)	0.2	0.6	0.2
5	Ash (g)	0.4	0.5	0.4
6	Carbohydrates (g)	10.1	8.7	11.20
7	Fibers (g)	0.3	0.9	0.3
8	Calcium (mg)	17	14	33
9	Phosphorus (mg)	18	10	23
10	Iron (mg)	0.3	0.1	0.4
11	Zinc (mg)	0.03	0.1	0.3
12	Vitamin A (units)	80	30	190
13	Vitamin B 1 (mg)	0.04	0.04	0.08
14	Vitamin B2 (mg)	0.02	-	0.03
15	Nicotinic acid (mg)	0.2	0.10	0.2
16	Vitamin C (mg)	40	45	49
17	Citric acid (%)	1.28	7.07	1.42