

ECONOMIC ANALYSIS OF MANGO NURSERIES IN PAKISTAN

Ghulam Ali Jariko
Ashique Ali Jhatial
Abida Taherani

ABSTRACT

This paper is based on the primary data collected from randomly selected 80 mango nursery growers of Mirpurkhas district of Sindh province of Pakistan. There are well-established mango orchards and mango nurseries mainly located in this part of the province. Nevertheless, this study identifies a number of technical deficiencies in present mango nurseries. Among others, Planting of nursery beds near to the grown up trees, inadequate inter culturing practices, no identifiable labels, both for mother plants and the stock, improper selection of rootstock, widespread plant population, local seed and traditional grafting are some of the major shortcomings. A large number of nurseries are using rootstock from side shoots collected from producing orchards; such planting material may turn out to be inferior quickly. Grafting and budding is often badly carried out with the result that the majority of planting material is of a very poor standard. Mango nursery business needs high investment. Total cost of mango nursery was incurred Rs.259958/hectare. An average net return earned by the growers was Rs.494795/hectare in two years because nursery plants take two years to be ready for transplanting.

INTRODUCTION

Mango is considered as one of the royal fruits with widespread popularity and equally liked by all regardless of gender, age, and country. Mango also contributes several vitamins like A, C and D to the health. Excellence of taste, flavour and juiciness make mangoes loveable and famous amongst the fruits and it is known as the king of fruits. Pakistani mangoes are worldwide famous and earn the nation huge amount of foreign exchange every

year. Pakistan produces about one million ton of high quality mangoes of which about 48,000 metric tons are exported annually which earns lots of foreign exchange. The production of mangoes is the second major fruit of Pakistan after citrus in term of area and production. According to the recent investigation of Khushk & Memon (2004) its per capita consumption is about 6.7 k.g. in Pakistan.

Mango fruit is considered a very rich source of vitamins, also contains huge amount of proteins, sugars, organic acids, carbohydrates and minerals. In value-added products in the market, there has been big variety of fresh mango recipes such as mango ice cream, mango milk shake, squash, and so many more things like sweets and favorite desserts could be offered. Likewise, mango juice, pulp, jelly, chutney, jam, marmalade, pickles are also being manufactured by renowned industrial houses in the country and are also available in consumer packing. Most of these products are of exportable quality which help nation to have foreign exchange. In terms of climate and geography, Pakistan possesses significant position for growing world's best mango varieties.

The most popular commercial varieties are Anwar Retol, Dasehri, Langra, Chaunsa, Sindhri, Saharni, Alphonso, Pairi, Fazli and Neelam. All these varieties are different in colours and sizes, and each with a distinct flavour and taste. There are two types of mango varieties grown in different parts of Asia, monoembryonic and polyembryonic. In the monoembryonic group, seedlings are variable and consistent reproduction of any particular cultivar has to accomplish by sexual methods. In the polyembryonic group, plants may be raised from seeds. However, most of the cultivars belong to the monoenbryonic group in Pakistan. Longevity of the mango is considered to be one of the prime factors for its success and export. The longevity of the fruit depends on several factors such as genetic characteristics, growing conditions, pre-harvest environment and the time of harvesting. The genetically improved planting material, when grown under ideal conditions (cultural practices) and harvest at optimum stage of maturity can be kept for a longer period.

Like other fruits mango nursery is a specialized field due to its sensitivity. The procedure of growing nurseries is a specialized

skill and requires growers to pay attention to the garden and protect it with appropriate fencing. Fenced garden helps to keep animals away from the growing nursery. In garden, different type of saplings and seedlings of fruits plants, timbers, flowers, vegetables and spices are produced throughout the year with intensive care, management and skilled techniques. In order to manage mango nursery, there are number of factors involved for its success. The following preparations are considered important by mango growers and farmers; (i) land development, (ii) spading soil, (iii) seed bed preparation, (iv) seed collection and processing, (v) seeding, (vi) production of saplings and seedlings and their intercultural operations like grafting, (vii) budding weeding water management, (viii) pest management, and (ix) saplings and seedlings processing for selling and marketing. Development and management of mango nursery generates large informal employment as well in the country especially in Mirpurkhas Division of Sindh province. Moreover, the establishment of a mango nursery is a good source of income for nursery producers as well. Mango nurseries are managed at commercial level and marketed at national level. Nursery growers are the owners and their nursery size varies according to the availability of land, financial resources, professionalism and aims of the growing nurseries for commercial or personal reasons.

More recent investigation of Khushk *et. al.*, (2003) eighty per cent mango growers and farmers buy plants from commercial nurseries as compared to twenty per cent who manage on their own. Among several advantages of nursery growing, growers deem couple of advantages important (a) they select the best planting material for their own orchard with a minimum cost of production (b) they sell excess plants to neighboring growers to earn income. Keeping in view the importance of mango nurseries the study was initiated with the following objectives.

RESEARCH OBJECTIVES

1. To determine average per unit cost of production incurred by the mango nursery producers.
2. To investigate the physical productivity per unit of mango nursery and to estimate the returns realized by the producers.
3. To compute the average per unit return.
4. To determine input – output ratio involved in the mango nurseries.

METHODOLOGY

This study is based on primary data. Data were collected from mango nursery growers and owners. Pakistan possesses a very large number of well-established mango farms, especially in Hyderabad and Mirpurkhas divisions of Sindh and Multan in Punjab provinces. The mango nurseries are also located in these divisions. Mirpurkhas district was randomly selected for this study purpose. Sample survey was conducted followed by group discussion and key informant interviews.

ANALYTICAL TECHNIQUE

This section is divided into two sections. The first section describes the analytical techniques used to assess the existing cost of production of mango nurseries. The second section describes the sampling frame, sample size and data collection procedure. Resource Valuation Production of farm commodities involves numerous relations between resources and commodities. Some of these relationships are simple while other is complex. But, according to Heady (1964) they all provide the tools by mean of which problems of production can be analyzed. The production function is best expressed the way in which output are produced by inputs and the way inputs cooperate with each other in varying proportion to produce any given output of products.

A production function can be expressed in the form of: The production function has been used to analyze the data collected from the commercial mango nurseries. The various resources or output as entered into the production process was evaluated at the prevailing market price. The cultural operations were considered the basis to quantify various inputs. Land Inputs The land inputs were measured on the basis of area under mango nursery at the selected diversified farms. The main component of land inputs included the rent of land, irrigation charges and usher tax. Market rate of leasing out of a hectare of land for mango nurseries as prevalent in the area was considered as an appropriate criteria on to compute rent of land, inputs for mango nurseries.

Labour Inputs Labour inputs include sowing of mango stone, weeding, grafting and removal of mango plant as prevailing in the area. Therefore, labour inputs as employed to grow various enterprises were estimated on the basis of opportunity cost

principle. The following formula was used to calculate the labour inputs. The same equation was used for all the operations carrying out enterprises at the selected farm study in Thatta district of Sindh. Capital Inputs The capital inputs used in the various enterprises included seed, farmyard manure, and fertilizer. The actual expenses are incurred by the respondents on these capital inputs were investigated from farmers and means of data were computed for all the farmers.

Sample Size

The aim of this study was to over view the existing nursery management system and to estimate the cost of mango nurseries. It is widely believed that it is almost impossible to collect data from whole population for an empirical investigation. Given the time, finance constraints, the decision was made in selecting the sample size. A sample size of 60 is generally regarded as a minimum requirement that will provide sufficient level but it was found that most researchers selected sample size between 100 to 150 to achieve the stated objectives. Keeping in view of the time, finance, travelling and data management a decision was taken to interview 80 growers or owners of mango nurseries in the area under investigation. Sample size was considered adequate in term of depth and accuracy required and in terms of time and resources available for the research study.

RESULTS AND DISCUSSION

Nursery Management System Land Preparation The land preparation is very important operation to provide suitable seedbed and soil conditions for seed germination, development and growth. Before sowing of seed, three to four dry plowings should be done followed by clod crushing and leveling. To maintain the soil fertility, farm yard manure can be applied. It was found that growers used three disc ploughs with two cultivators and level their land before planting. Growers applied 2 truck of FYM in field for land preparation for mango nursery. Sowing of Mango Stone A stock for grafting or budding is raised from stones of mangoes. Careful selection is made of the parent trees as the progenies differ in germination and vigour which ultimately affect the time required for raising plant large enough for grafting or budding. The

propagation of mango starts from seed, and involves collection of the stones of fully ripe fruit in the months of July and August. These stones can be stored at one place and kept moist till sown. Stones can be planted in well-prepared and heavily manured soil at a depth of 1.5 to 2 inches by either of the following two methods.

The size of seed of fruit does not affect the germination or the vigour of seedlings. Sowing of the seed with plumule is helpful in avoiding distortion of seedlings. Stones when planted fresh germinate within 15 to 20 days. The stones can be broadcasted in the well-prepared land very closely. This is done just to ensure uniform germination. Seed stones must be covered with well rotten farmyard manure. In this method a large quantity of seed stones is required. The seeds are sown 6 inches apart in 2 1/2 foot rows, in well prepared and heavily manured flat beds of 8' x 16' in the month of June and irrigation water should be applied frequently to avoid drying up of the stones, which results in poor germination. It was reported that stones stored and planted within one month gave 88% germination and stones planted after 71 days gave only 12% germination (Khushk *et. al.*, 2003). It is therefore, recommended that stones should be planted soon after they have been extracted from the fruit. Nursery owners reported that they purchased seed stones from juice factories, therefore, they do not know how long they were stored and whether stones are from mature or immature fruit. Before seed stone are planted, they need to be kept in the water as long as they germinate. Once they are germinated they need to be broadcast in well-organized nursery field.

Time of Sowing

Timely sowing of mango nursery is an important factor for its rapid and successfully growth. Seed stones sown on proper time gave best germination. 80 per cent are usually planted in month of July and 20 per cent in month of June. Growers used 80 bags (40 kg) of mango stones per hectare. For sowing of one hectare 35 to 40 labourers are required. Irrigation Meticulous care in regular watering at weekly intervals is necessary for their speedy germination and growth. Broadcasting and irrigation go side-side until the plants grow and get healthy. Growers applied on average 18 irrigations until maturity and transfer of plants from nursery. Weeding Weeds are unwanted plants which are not intentionally

sown and have no economic value. They compete with the main plant or crop in air, light; water and nutrient up take and reduce the growth of plant. Growers reported they have done first weeding after two months of sowing. A total of five weeding were done until removal of plants from the nursery.

Fertilizers

The recommended dose of chemical fertilizer is 125 Lbs N per hectare when plants are, 3 months, old. Growers applied 75 bags of DAP and 2 bag of Urea per hectare until removal of plant from nursery.

Mango Grafting

There are three methods of mango grafting which in practice in the area under investigation. The "veneer grafting" has one striking advantage in using the detached scion sticks for propagation, i.e. the shoot of the mother plant which has multiple offshoots can be cut away from the mother plant and taken to the seedling growing nursery for grafting. Proper selection of scion is very important for the success of this method. The veneer grafting is simple and easy. Many fruit growers have taken it up for nursery management. These are not only producing the plants for their own orchards but have started selling the grafted saplings to other growers also. Persons who have not got their own orchards have also started the nursery business by purchasing the scion sticks from the mango orchardists. Thus this method of plant propagation has revolutionized the nursery production in the province.

Another method of mango nursery growing is known as 'soft-wood grafting'. In this method seedlings are grown for one year for rootstock. Seedlings then grow to sustainability level with their leaves turning bronze. Then seedlings are deemed ready for softwood grafting. Additionally, shoot of three to four months appear prominent apical bud and are taken as scion material. Leaf lamina from such shoots is removed about a week before detaching them from the parent tree. Whilst removing shoots from their parent trees especial care is taken to keep apical bud intact and safe for further growth. The top of the new growth of the stock is cut and wedge grafting fits the scion and united with 200 gauges

polythene tape. Proper selection of rootstock and scion makes it sure to have 100 per cent success during July-August.

Seedlings big enough for grafting which have attained a height of 1 1/2 to 2 feet, a stem thickness of 1/3 to 1/2 inch, are selected, during February- March i.e. 8 to 9 months after sowing of stones. Nursery growers believe that grafting shoots with mature leaves around apical bud are suitable and give best results. For this, correct procedure to be followed is: leaves are removed at least one week prior from the selected scion wood. Then defoliated scion stick to about 10-15 cm length needs to be cut. The basal end is axed to form a wedge. In the rootstock, cut back the plant at a place where stem thickness is equal to that of the scion wood. Growers carefully split the stock stem stump down and insert the scion and tightly wrap the union with a polyethylene tape. To prevent drying off of the scion wood, cover it with a polyethylene bag. Or else keep the grafted plants inside a propagator. Such measures will ensure a high success rate of grafting.

A third method of grafting is called 'epicotyl grafting'. Under this method of growing mango nursery, germinating seeds between four to eight days old are used as rootstocks. The scions are prepared by prior defoliation of shoots of comparative thickness. Splice and wedge methods are used for grafting. For this, the epicotyl is cut slightly between 22 and 23 cm in the length. Additionally, the lower part of the scion is made to cut to the same size. The surfaces of both the stock and scion are knotted tightly in a way that the cambium of both stay attached to each other. Soon after tying both the parts they need to be planted and watered for further growth. Rainy days are good for the proper growth of grafting due to the high humidity which helps plants grow faster and healthier. There is no commercial practice of propagating of mango through cutting or air-layering. However, these methods have been tried with varying degree of success. Propagation of mango through budding is comparatively cheaper and quicker than the above methods, but the percentage of success is not higher than the grafting. Therefore, investigation was carried out at Horticultural Research Institute Mirpurkhas to bring improvements in the present techniques.

To assess the suitable time of budding in mango an investigation was carried out at the time when root-stick was in

flush. The results showed that February-March and August-September were more suitable for budding (Jagirdar, 1968). Jagirdar also tried to investigate the percentage of success of mango budding on a weekly basis, in February-March in spring and August in the summer season. He found the highest success of budding in the first two weeks of March and August. In the study area it was found that nursery growers and owners provide grafting material with minimum charges of labour e.g. *malhi-a gardner*. 90% success of grafting was reported by the respondents. After the age of 2 years, these plants would be ready for transplanting to the mango orchards.

Number of Plants

Number of plants per hectare depends upon quality of mango stone and land type. It was found that majority of producers grow nursery in mango orchards which results less plant population. Production of mango plants in a nursery was investigated and found that in an average of 60392 plants were produced in a hectare. The survival percentage was from 50% to 90% with an average of 70 per cent. The number of plants that survived per hectare was 41931 plants. Mango Varieties Growers informed that they grafted different varieties according to demand of growers.

Survey Results shows that Sindhri variety was most common and was produced 30 percent followed by Desheri 21 percent, Langro 13 percent, Chauso 12 percent, Saroli 8 percent, Sonaro 7 percent, Anwar Ratol 4 percent, Neelam 3 percent and others varieties 2 percent in the study area. Prices The prices of mango nursery plant depend on supply and demand basis. The prices of mango plants were collected on variety wise and found that the highest price Rs. 45 per plant received by the Lal Badshah followed by Rs. 35 per plant of Black Chauso but these varieties The economic analysis describes the methods used in analyzing the economic behavior and the application of the results obtained to solve the economic problems (David, 1979). The fixed costs of mango nursery start with the development of land and continue till the graft is ready to be planted major costs include land development, labour and machinery costs. And the land development cost alone includes ploughing, planking, leveling and lay out of the field. The land rent, government taxes and mark-

up on the fixed capital have been included in the fixed costs. The wages of permanent labour and repair of farm equipment and other miscellaneous costs were considered as fixed costs (Norman *et. al.*, 1985).

The variable cost consists of production practices and input costs including FYM, fertilizer, pesticides, wages, inter culturing, spraying, harvesting, handling, and transportation. These costs are known as working capital (Nix, 1979). The variable costs were collected from mango nursery producers. The variable costs are those, which are specific to an enterprise and vary with its scale. The variable cost consists of land management, crop inputs; FYM, fertilizers, pesticides irrigation and in addition to the payments for hired labour for crop production activities.

The variable cost varies from farm to farm and from one to another grower, because some growers hire labor and others engaged family labor for sowing, weeding, grafting and removal of plants from nursery. Mango nursery business needs high investment especially in labour charges. An expenditure of Rs. 162936/hectare on labour charges included Rs.83861/ hectare was on removal of plants followed by Rs.62899/ hectare on grafting charges, Rs.10745/ hectare on manual weeding and Rs. 5434/ hectare on sowing. Results indicate that the highest costs from nursery, Rs. 41990/ hectare on mango stone, Rs.12745/ hectare on FYM, Rs. 6447/ hectare on fertilizer, and Rs. 2371/ hectare polyethylene tape used in grafting. The total variable cost incurred by mango nursery growers was Rs. 226489/ hectare. Results indicate that the highest cost of Rs.226489/hectare was incurred by growers as variable costs, included Rs. 162936/hectare on labour charges, Rs.12745/ hectare on FYM, Rs. 6447/ hectare on fertilizer, and Rs. 2371/hectare polyethylene tape used in grafting; followed by Rs.33469/hectare as fixed costs. Total cost of mango nursery was incurred Rs.259958/ hectare. Table 1 indicates that total cost of mango plant was Rs.6.20/plant and grower take net return of Rs.11.80/plant. An average net return earned by the selected growers of mango nursery in study area was Rs. 494795/hectare in two years because nursery plants take two years to be ready for transplanting.

CONCLUSIONS AND RECOMMENDATIONS

Study aimed to present economic analysis of growing mango nursery. Empirical data gathered from Mirpurkhas Division of Sindh for analysis. This study identified several technical deficiencies in the development and growing of mango nurseries at commercial level. Study suggests that nursery beds should not be very near big and grown up mango trees, inappropriate inter culturing practices should be improved, there has been complete absence of labeling of both the mother plants and the stock which need to be addressed for sound identification of the plant. In addition to these, growers should pay more attention on the proper selection of rootstock, planting population at close distance will not contribute to steady and healthy growth of plants, local seed and traditional grafting should be avoided for better results. Moreover, study also recommends that growers should develop land properly with healthy material and good grafts would help achieve good yield and quality produce. There is strong need to take advantage of modern methods and procedures over traditional methods for greater results. In a way, a more well-established commercial nursery will take place. New and sophisticated planting techniques with modern technology should be adopted by the nursery growers. Study suggests growers to take advantage of following techniques: (a) select root stock from known poly embryonic cultivars and rouging out of abnormal seedlings at an early stage, (b) selection of scion bud wood from known high yielding mother trees, and (c) selection of proper method of budding/grafting of nursery rootstocks. In addition, the nursery site must be away from the mature mango plants and the plants being kept at wide spacing. Staff should be provided training and mentoring and properly monitored during working in the field with the aim that well-trained staff will carry out budding, grafting and planting material is correctly labeled, for better results. Growers are only able to judge the performance of these plants after 5 years when they start bearing fruits. Therefore, it is necessary that the source of scion material should fulfill all the conditions laid down on the basis of scientific observation. These are: (i) the parent plant must have been tested for its performance over a number of years, (ii) it must be free from transmittable diseases, and (iii) fruit shape, size, taste and flavour must conform to the typical specifications of

the variety. However, it was observed during the survey that a majority of the mango nurseries have been raised under very poor conditions and even some are being propagated under the shade of mature mango plants. A large number of nurseries are using rootstock from side shoots collected from producing orchards; such planting material may turn out to be inferior quickly. Grafting and budding is often badly carried out with the result that the majority of planting material is of a very poor standard. At this stage, public involvement in production of nursery stock is not suggested, but government should support development of private sector nurseries. The public sector should provide only technical support such as, supply of high quality planting material, provision of credit facilities and implementation of a regulatory framework for quality control and certification.

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