ABSTRACT

A study was conducted at Social Sciences Institute, National Agricultural Research Centre, Islamabad during 2006. Analysis of financial viability of long-term investment in citrus orchards in Punjab province of Pakistan was carried out to generate valuable information for citrus growers, market traders and policy makers to enhance investment in citrus orchards. The results indicated that citrus production starts at 5 years age of citrus orchard and it reaches maximum level during 21st year and remains constant up to 30th year. Return in investment of citrus orchard was found 33 percent against current rate of interest on agricultural loan. The pay back period of citrus orchard was observed as 7th year with non-intercropping and 5th and 6th year when intercropped with wheat and berseem, respectively. Moreover, analysis indicates that 20 years is optimum economic life of citrus orchard, after that there is a declining trend of citrus production potential.

KEYWORDS: Citrus fruits; investment; profitability; Punjab, Pakistan.

INTRODUCTION

Despite laissez faire type approach of government towards the development of horticultural crops, area and production of citrus in Punjab had annually increased by 5.6 and 4.7 percent, respectively during 1980-81 to 1990-91. This pace could not be maintained during 1991-92 to 2001-02, as corresponding annual growth rates dropped to 1.08 and 1.06 percent, respectively. During last two decades, different expansion rates in area and production were noted in all districts of Punjab. For instance, during 1980-81, old-Faisalabad, Sargodha and R. Y. Khan were major citrus growing districts while since 2001-02, Sargodha-Khushab is the largest citrus growing belt of Punjab followed by Sahiwal and old-Multan (6). Hence at present, Sargodha-Khushab are main citrus growing districts of Punjab which have experienced an increasing growth rate of area and production of citrus for last two
decades. The question arises why growers of Sargodha made long-term investment in citrus orchards? This requires an analysis of financial viability of such long-term investment.

Planning of citrus orchard is basically an economic and resource allocation decision. A citrus orchard is not only planting of trees on a piece of land, but it requires continuous care and application of necessary inputs around the year. Growers have to decide whether they should allocate their scarce resources (land, labour, capital and entrepreneur) to plant citrus orchard or they should utilize these resources for other crops. For an orchard plantation, a grower has to pay various fixed and variable costs. Fixed costs include all those costs, which start from planting of a tree until it starts fruiting. The fixed costs will be considered as the initial capital investment. In Pakistan, like other developing countries, there is lack of information, particularly on financial viability of long-term investment in fruit crops (5). In other words, there is lack of reliable and accurate information among various stakeholders ranging from growers, market traders, investors and finally to policy makers. The present study is an attempt to generate reliable and authentic information on financial viability of long-term investment in citrus orchard. To do that, three parameters i.e. (1) to invest in citrus orchard, (2) pay-back period of establishing a citrus orchard and (3) optimum economic life of citrus orchard are addressed:

**MATERIALS AND METHODS**

Investment appraisal analysis was carried out at Social Sciences Research Institute, National Agricultural Research Centre, Islamabad during 2006 to determine extent of incentives for future investment in citrus orchards. In field crops, producers usually consider finances involved and profits obtained in one season. In case of orchards, flow of future costs and returns are also important. Two methods are commonly used to appraise investment decisions: (i) pay back method and (ii) return on capital. Pay back method is based on time taken to repay the capital invested. In other words, a project is feasible if it has the ability to payback investment with predetermined period. This method can also be used to compare project in hand with other projects, i.e. projects can be ranked based on speed of pay back. Faster paying-back projects are naturally favoured more than slow ones (6). Second method “Return on Capital” is also used for investment decision-making. In this method profit from an investment is estimated after deducting depreciation cost and before incorporating taxation allowance (6). In addition to farm profitability, there are two more advanced techniques based on analysis of
discounted cash flows (DFC) viz. net present value (NPV) and internal rate of return (IRR).

Data collection and cost calculation

Cross sectional data were collected from 125 citrus producers from teshil Bhalwal, district Sargodha. The estimation of various types of costs is briefly discussed below:

Ploughing and planking: Prevailing tractor rental rates for ploughing were used irrespective of ownership of tractor.

Farm yard manure (FYM): Following Ahmad et al. (1) and Chaudhry et al. (3) FYM costs include FYM value and its transportation charges.

Fertilizer: Prevailing prices of fertilizer in market were used to compute value of fertilizer applied with transport charges.

Irrigation: For canal irrigation water rates fixed by the government were used. For tubewell water, rate at which tubewell water can be purchased (i.e. market rate) was used irrespective of the fact whether farmer owns or does not own his tubewell (1).

Plant protection: Actual prices paid by the farmers on purchase of chemical plus spraying cost were used as plant protection cost.

Labour: Three types of labour used on the farm are; family labour, permanent hired labour and casual hired labour. The total labour used in various agricultural operations (application of FYM, fertilizer and pesticide, weeding, hoeing and irrigation) was estimated by multiplying time required for one operation multiplied by number of operations performed. The standard time for one operation of every activity specified as by Chaudhry et al. (3) was used. Market or hiring wage rate was used for calculating cost of types of labour used in citrus production.

Transportation cost: Actual price paid by farmers for transportation was used.

Interest or markup: Markup @ 12 percent on relevant cost items was used for the period a crop remains in field.

Land rent: Prevailing market land rent in study area was used.
Harvesting and threshing costs: Harvesting and threshing charges actually paid by the farmer were included only for the crops intercropped in citrus orchards. In case of payment in kind, value of commodity was computed at farm gate price of main product. Operation specific hiring rates were used for all types of labour.

Yield of crop and byproducts: In case of wheat and sugarcane, physical output of main product and byproducts obtained in each season and market prices were used for computing value of output. In case of fodder crops, value of output is taken directly.

On the other hand, discounting methodology is used to evaluate cost and return in perennial crop like citrus orchards because growing fruit trees represent long-term investment. The first few years of such enterprise involve costs. To make a sensible comparison of three growing activities with annual enterprises a basic approach is to estimate annual net present worth by discounting both future costs and returns (1).

Generally, citrus trees do not start bearing fruit till fifth years of their life and annual fruit harvest is divided into two distinct yield cycles: first, from fifth to end of 10th year; and second from 11th year to 20th year before replacement. The main difference between these two cycles is average number of Kinnows per tree that can be harvested annually. The yield in second cycle is much higher than first cycle (1).

Net present value (NPV)

The basic criterion of this assessment is that an investment is said to be worthwhile, when money received from an investment is at least equal to money invested. The decision rule of this technique is to accept those projects which have a positive or zero NPV and reject those investment which have a negative NPV. The present value of an investment is the sum of its net discounted future cash flows:

\[
NPV = \sum_{t=0}^{n} \frac{A_t}{(1 + r)^t}
\]

where, \( A_t \) is the project’s cash flow (either positive or negative) in time (takes on value from year 0 to \( n \), where \( n \) represents the point in time when project completes its life “\( r \)” is the annual rate of discount or time value of money which is assumed to remain as constant over life of project).
Internal rate of return (IRR)

IRR is known as rate of discount, normally applied to calculate an investment’s cash flow. It is estimated such that NPV of net income stream becomes zero. The decision rule in this approach is to accept that investment having an IRR greater than or equal to market rate. Simply IRR is value of “r” which satisfy following expression.

\[ \sum_{t=0} A \frac{1}{(1 + r)^t} = 0 \]

Equivalent annual annuity (EAA)

Meikle (7) stated that EAA is a useful tool to determine economic life of an orchard by calculating break-even cash flow.

\[ EAA = \frac{NPV}{\sum DF} \]

NPV is already defined in previous section. DF means discount factor which is assumed as 12 percent per annum. Hayton (4) and Khushk and Smith (5) also used same procedure to estimate economic life of apple and mango, respectively.

RESULTS AND DISCUSSION

Depending upon nature of management practices and trees saved from insect pests and disease epidemics, productive life of a citrus tree ranges between 3-30. The results of study reveals that citrus production starts during fifth year after planting of citrus and reaches a maximum level during 21-30 years. Results also indicate that maximum revenue start declinging to end of life of tree (Table 1). An old orchard may produce a good yield, but it will be of lower quality than that of young citrus orchards. Also old orchards often have high management costs, particularly, interculture and input supply. It was reported by respondents that cost of interculturing in old orchards was more than double that in young citrus orchards. There is little assessment by citrus growers of optimum time for replacement of old orchards.

Table 1. Estimated annual costs and revenues of citrus (Kinnow variety) cultivation non-intercropped.
Table 2 indicates a negative cash flow up to 5th year, because citrus trees start fruited after four years and expenses are incurred on care every year without any return from intercropping. The cash flow turns positive at 5th year. Cash flow remains higher from 6th to 30th year. After that cash flow declined up to 50 years of age. To calculate NPV cash flow was discounted with inflation. NPV was estimated as 194193 rupees @ 12 percent discount rate and internal rate of return was 34 percent.

Intercropping in citrus orchards is commonly practiced in the area. It starts right from first year of its planting and continues even after fruited starts till tree canopy spreads so much that it becomes difficult for tractor to plough (i.e. mostly up to 10 years). The revenue received from these crops brings returns from same field in early years of citrus trees. The revenue received from these crops makes overall return from the same field more attractive for growers. From an economic point of view intercropping in young citrus orchards brings extra revenue from the same piece of land.

The data (Table 3) show a negative cash flow for year 1-4 with wheat intercropping and revenue from intercrop, a positive cash crop starts from 5th year after planting orchard. Maximum cash flow was obtained during 5-10 year when revenue was received from intercropping as well as citrus. Net present value was Rs. 185446 and internal rate of return was 49 percent.

Table 2. Estimated cash flow of one hectare of citrus (Kinnow) orchard without intercropping
Table 3. Estimated cash flow of one hectare of citrus (Kinnow) orchard intercropped with wheat.

<table>
<thead>
<tr>
<th>Year</th>
<th>Costs (Rs/ha)</th>
<th>Revenues (Rs/ha)</th>
<th>Net benefits (cash flow)</th>
<th>Present worth @ 12%</th>
<th>Present worth @ 20%</th>
<th>Present worth @ 30%</th>
<th>Cumulative cash flow</th>
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<td>1.</td>
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<td>-12333</td>
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<tr>
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<tr>
<td>5.</td>
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<tr>
<td>6.</td>
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<td>49261</td>
<td>2990</td>
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<td>NPV</td>
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<td>34%</td>
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</table>

1 US$ = Rupees 60/-

The data (Table 4) show a negative cash flow for year 1-4 with berseem intercropping and revenue from intercrop, a positive cash crop started from 5th year after planting orchard. Maximum cash flow was obtained 6-10 year when revenue was received from intercropping as well as citrus. Net present value was Rs. 158722 and internal rate of return was 47 percent.
Table 4. Estimated cash flow of one hectare of citrus (Kinnow) intercropped with berseem.

<table>
<thead>
<tr>
<th>Year</th>
<th>Costs (Rs/ha)</th>
<th>Revenues (Rs/ha)</th>
<th>Net Benefits (cash/flow)</th>
<th>Present worth @ 12%</th>
<th>Present worth @ 20%</th>
<th>Present worth @ 30%</th>
<th>Cumulative cash flow</th>
</tr>
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<tr>
<td>1.</td>
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<td>6.</td>
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<td>78405</td>
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<td>7.</td>
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<td>492</td>
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<td>41 to 50</td>
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<td>NPV</td>
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<td>62,746</td>
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<td>IRR</td>
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</table>

1 US$ = Rupees 60/-

Replacement problem is common one for perennial agricultural commodities, particularly for orchards. The growers, investors and market traders need to know economic life of citrus orchards so that they can plan further investment in this sector. If an orchard is financially non-viable then growers have several options. First, they can uproot the orchard. Secondly, they can remove an old orchard and replant a new orchard. Thirdly, they can replace orchard with other enterprises. These alternative options can be examined by analyzing equivalent annual annuity (EAA) of citrus orchard.

The results (Table 5) showed higher values for EAA, Rs. 11605 per hectare at age of 11-20 years and after that EAA value started declining. This indicates that 20 years is optimum economic life of citrus (kinnow) orchards; after that there is a declining trend of citrus production potential. It may produce attractive yield but it will bear poor quality and with higher management costs. EAA is computed on assumption of both gross returns and costs remained the same for every year for 11-20 years and therefore, estimation cannot go year by year. Citrus producers were re-visited in 3rd week of August, 2006 reported that citrus bears maximum fruit at age of 18-22 years. This finding also supported conclusion of 20 years as an optimum life of citrus orchards.

Table 5. Estimated cash flow of one hectare of non-intercropped citrus (Kinnow) orchard.

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Year | Net benefits cash flow (a) | Disc. Factor @ 12% | NPV (b) | Cumulative NPV | EAA
--- | --- | --- | --- | --- | ---
1. | -12333 | 0.893 | -11013 | -11013.00 | -1326
2. | -26903 | 0.797 | -21442 | -32455.03 | -2582
3. | -26903 | 0.712 | -19155 | -51610.14 | -2306
4. | -26903 | 0.636 | -17110 | -68720.59 | -2060
5. | 43150 | 0.567 | 24466 | -44254.76 | 2946
6. | 47306 | 0.507 | 23984 | -20270.69 | 2888
7. | 47306 | 0.452 | 21382 | 1111.56 | 2575
8. | 47306 | 0.404 | 19112 | 20223.13 | 2301
9. | 47306 | 0.361 | 17077 | 37300.54 | 2056
10 | 47306 | 0.322 | 15232 | 52533.03 | 1834
11 to 20 | 52978 | 1.8192 | 96378 | 148911.13 | 11605
21 to 30 | 55841 | 0.5857 | 32706 | 181617.25 | 3938
31 to 40 | 50766 | 0.1886 | 9574 | 191191.65 | 1153
41 to 50 | 49261 | 0.0607 | 2990 | 184181.79 | 360
NPV | 194,193 | | | | |
IRR | 34% | 8.3052

Source: Survey data, 2000, 1 US$ = Rupees 60/-

Intercropping with wheat and berseem (Table 3 and 4) gave higher IRR compared to sole orchards (Table 5). Absolute value of NPV of these intercropping rotations is low and IRR is high. IRR in fact depends upon the shape of stream of benefits and costs. Benefits occurring earlier in project life tends to raise IRR. On the other hand, benefits occurring in later years of the project (5th year in case of non-intercropped orchards) (5) will tend to depress IRR. Hence, NPV remains main deciding factor. The risk averse kinnow growers would like to have high IRR, while risk lovers may prefer high NPV. This in fact explains why many farmers practice intercropping. There is a need to develop other mechanisms of risk sharing so that farmers can depend upon those mechanisms to reduce risk rather than on intercropped with wheat and berseem. Therefore, in long-run, sole citrus orchard farming proved to be more profitable option than of intercropped one. Howefer, flow of benefits occurring in earlier age of project life from intercropping provides funds to finance for the purchase of inputs for orchard. On the other hand, biological scientists also allow intercropping before orchard start fruiting. In terms of net income per hectare, the highest profitability was found for sole matured orchards aged 11-20 years followed by sole mature orchards aged 6-10 years and wheat intercropped orchard aged 6-10 years. The study findings also confirm the profitability of intercropping in young orchard and discourage intercropping in matured orchard.

CONCLUSION
The study concludes that investment in citrus orchards has provided favourable returns on capital investment in both cases with and without intercropping. The returns on investment in citrus orchards was determined and found higher against current rate of interest on agricultural loans, i.e. 12% per annum. Intercropping in young orchards is widely acceptable among growers and found to be technically feasible and economically viable. The pay-back period of citrus orchard starts from 7th year in case of non-intercropping, 5th year when wheat was intercropped and 6th year if berseem was intercropped.

The study also concludes that 20 years is peak output period of citrus tree, after that its productivity declines. There is lack of information among citrus growers, particularly for economic life of citrus orchards. This indicates that poor performance of extension and research agencies and need to widely disseminate such information for replacement of old citrus orchards. The profitability of long-term investment in citrus orchards is sufficiently high and it is unlikely that cost of inputs (fertilizer and pesticides) and price of output may change so drastically to reduce incentives to establish or replant orchards. There is a need to stabilize citrus prices by improving existing marketing system and export policy.

REFERENCES