

# Original Research Article

## Financial feasibility of poultry layer farms in Chittoor district, India

### ABSTRACT

The present study (attempts) is an attempt to assess (the) financial feasibility of layer farms of poultry birds in (the) Chittoor district of Andhra Pradesh, India. In total, 60 farms were considered for the study, with 20 each for small, medium and large size. The data was collected from poultry farmers with the help of a pretested questionnaire. The Net Present Worth is highest for large farms followed by medium and small farms at both 12 and 16% discount rates, which in turn prove proving the economic viability of farms. The Benefit-Cost Ratio was positively related with to farm-size, and the large farms were economically more viable. The internal rate of return is higher than that of the discount rate for all sizes of farms which implies that investment is feasible. Even though the returns are decreased by 10% (Case I) or Costs increased by 10% (Case II), the small, medium and large poultry layer farms are economically feasible at both 12% and 16% discount rates as NPV is positive and BCR is greater than 1. But if the returns are decreased by 10% and Costs increased by 10% (Case III), the small farms become financially infeasible at both discount rates, whereas medium farms become financially infeasible at a 16% discount rate only. The large layer farms are economically feasible at both discount rates if the returns are decreased by 10% and Costs increased by 10% (Case III). On the basis of (Based on) NPV, BCR and IRR, investment in layer farming was found to be most profitable in large farms, followed by medium and small farms. This was due to the fact that (because) the benefits per bird were highest, and the cost of production was lowest on large farms. The study revealed that poultry layer farming is a profitable business in the Chittoor district.

*Keywords: Poultry, layer farms, NPV, BCR, IRR,*

### 1. INTRODUCTION

Poultry is one of the promising segments of the agricultural sector in India. Egg production is increasing at the fast pace of 8 per cent per annum, whereas crop production is increasing at a slow pace of 1.5 to 2 per cent per annum. The egg production in India is 75 billion in the year 2017. Out of which 75% of eggs are produced from organised farms and the remaining 25% produced from backyard poultry farming. Consumption of poultry products increased in India owing to changing food habits of people.

Andhra Pradesh is one of the promising states in India in promoting the Livestock Sector. The state stands first both in egg and meat production. The Egg Production in the State in the year 2017-18 is 17.78 billion. This constitutes 23.71% of the total egg production in the country (75 billion) i.e., every fifth egg produced in the country comes from Andhra Pradesh. Thus, the State can be called "EGG BASKET" of the country. The predominant egg producing districts in the state are East Godavari, West Godavari, Krishna, Guntur, Chittoor

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and Visakhapatnam Districts. Nearly a million jobs are created by the poultry sector in Andhra Pradesh. The Poultry sector contributes approximately Rs.90,000 cr. to the GDP of India and about Rs.8217 cr. to the economy of Andhra Pradesh.

The Chittoor district has the largest number of poultrys and hatcheries, and thousands of families depend on them. Chittoor is the fifth largest egg producing district in Andhra Pradesh. In the year 2017-18, 12770.63 lakhs of eggs are produced in this district. The present study is an attempt to assess the financial feasibility of layer farms of different sizes in Andhra Pradesh.

## 2. LITERATURE REVIEW

Bharathi [1] while evaluating the profitability of poultry enterprise worked out the IRR as 29.67 per cent for small farms and 32.35 per cent for large farms, which is quite higher than existing bank interest rate. The benefit cost ratio ranged from 1.15 to 1.06 on small and large farms respectively. The net present value was positive both for small and large farms. All these indicators showed that poultry production is economically viable. The results further revealed that it would take about four years to recover the entire investment made on poultry farm on an average.

Mohsin et al. [2] attempted profitability analysis of broiler production in Rawalpindi district of Pakistan. They observed that on small broiler farms, BCR was less than one, and NPW was negative. They were 0.95 and Rs. -34718. On medium farms, the benefit-cost ratio (BCR) and net present worth (NPW) were 1.10 and Rs.9332, respectively. On large broiler farms, the BCR and NPW were 1.34 and Rs.78,094, respectively. This indicates that small broiler farms were in loss while medium and large farms were making profits. The results of marginal analysis showed that marginal rate of return (MRR) for small to medium farms was 169.20 per cent and for medium to large farms, 156.97 per cent. It means when we increase the broiler farm size from small to medium, the poultry farmer was expected to recover Rs.1.00 along with additional Rs.1.69. Similarly, when we shift farm size from medium to large, the broiler farmers expect to recover Rs.1.00 along with an additional Rs.1.56.

Ahmad et al. [3] in an economic analysis of broiler production in Allahabad district, found that the Benefit-Cost ratio was 1.19, 1.20 and 1.30 for the broiler farms in the above order. Net Present Value (NPV) calculated for small farms was Rs.23,324.95, medium size farms Rs.53,080.13 and large farms Rs.1,44,583.26. They concluded that large farms received higher profits as compared to medium and small farms.

Singh et al. [4] studying the worthiness of investment in broiler farming, measured the productivity of capital. They reported that net present value (NPV) was highest among large broiler farms (Rs.26,62,245) followed by medium (Rs.6,91,352) and small (Rs.1,76,126), showing an increasing trend with the increase in farm size. It indicates that investment on-in all farm sizes turned out to be an economically paying preposition as the net present value was positive in all farms. Benefit-Cost Ratio (BCR) was 1.04, 1.08 and 1.12 for small, medium and large broiler farms. It increased with increase in farm size, and the large farms were economically more viable. The internal rate of return (IRR) was highest on large farms (33.32 per cent) followed by medium (29.07 per cent) and small (23.30 per cent) farms. Since IRR is greater than discount rate representing the opportunity cost of capital, farms of all three sizes are financially viable.

A project report for commercial layer farming of 5000 capacity [5] prepared by West Bengal Poultry Federation and NECC laid down that layer farm of that size is lucrative as indicated by IRR (48.05 per cent), B-C ratio (1.13) and NPV (Rs.19,82,943) worked out.

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In a pre-feasibility study for 30,000 layers made by Small and Medium Enterprises Development Authority (SMEDA), Government of Pakistan [6], IRR, NPV and payback period were worked out. They were 45 per cent, Rs. 65,852,862 and 4.32 years respectively. These economic indicators amply established the profitability of layer farming. SMEDA conducted many such studies. The results of financial analysis vindicated the above finding.

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Dinesh and Sharma [7] studied 100 poultry farms of layers in Namakkal district of Tamil Nadu to assess the financial feasibility of farms of various sizes. Based on the values of net present value, benefit-cost ratio and internal rate of return, layer farms of all size group layer farms are found to be financially viable and most profitable. While the Net Present Value of investments in small, medium and large farms at 15% discount rate were Rs. 1,94,926, Rs. 6,85,979 and Rs. 25,48,436 respectively. The benefit cost ratio was higher in large farms at 1.033 followed by medium (1.030) and small farms (1.019). the internal rate of return is highest for the large farm was 31.15 per cent whereas for small farms and medium farms were 22.89 per cent and 23.06 per cent, respectively.

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### 3. METHODOLOGY

The study was conducted in Chittoor district of Andhra Pradesh. The layer farms are grouped into 3 categories based on number of birds, small ( $\leq 5000$  birds), medium (5001-20000 birds) and large ( $>20001$  birds). 20 layer farms are selected from each of these groups i.e., in total 60 farms are considered for the study.

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Discuss more on your methods selected for study – why have you selected the three methods? How did you collect the data – source?

#### 3.1 Net Present Value

It is also sometimes referred as net present worth (NPW). It is the present worth of the incremental net benefits or incremental cash flow stream. Net present value (NPV) of a project is estimated using the following formula.

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$$NPV = \sum_{j=1}^n \frac{B_j - C_j}{(1+i)^j} \dots \dots \dots (1)$$

Where

- $B_j$  = Benefits in  $j^{\text{th}}$  year
- $C_j$  = Costs in  $j^{\text{th}}$  year
- $i$  = Discount rate
- $n$  = Number of years
- $j$  = 1 to  $n$  years

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The net present value (NPV) should be positive to indicate that the project investment is economically viable.

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#### 3.2 Benefit-Cost ratio (BCR)

It is the ratio of present value of costs and present value of benefits. For any project to be viable, Benefit-Cost ratio should be more than one. The project with highest Benefit-Cost ratio must be opted for implementation among the alternative projects. Benefit-Cost ratio is calculated using the following formula.

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$$B - C \text{ ratio} = \frac{\sum_{j=1}^n \frac{B_j}{(1+i)^j}}{\sum_{j=1}^n \frac{C_j}{(1+i)^j}} \text{-----(2)}$$

Where

- B<sub>j</sub> = Benefits in rupees in j<sup>th</sup> year
- C<sub>j</sub> = Costs in rupees in j<sup>th</sup> year
- i = Discount rate
- n = Number of years

In the present investigation, the net present value (NPV) and benefit-cost ratio (BCR) were calculated at 12 and 16 per cent discount rates.

### 3.3 Internal Rate of Return (IRR)

It represents the average earning capacity of an investment over the economic life period of the project. It is the discount rate at which the present values of cash flows are just equal to zero i.e., NPV = 0. In other words, the benefit-cost ratio calculated at IRR is unity. Mathematically, it can be represented as

$$IRR = \sum_{j=1}^n \frac{B_j - C_j}{(1+i)^j} - I \text{-----(3)}$$

Where

- B<sub>j</sub> = Benefits in rupees in j<sup>th</sup> year
- C<sub>j</sub> = Costs in rupees in j<sup>th</sup> year
- i = Discount rate
- n = Number of years
- I = initial investment

The internal rate of return (IRR) was calculated through interpolation technique by using different discount rates so as to see that the net present value is equated to zero. The lower and higher rates would be used to obtain positive and negative values of net present value respectively. Then the interpolation method indicated below was used to arrive at the IRR.

$$IRR = \text{Lower discount rate} + \text{Difference between 2 discount rates}$$

$$\times \left[ \frac{\text{Present value of cash flows at lower discount rate}}{\text{Absolute difference between the present values of cash flows at two discount rates}} \right]$$

When the calculated IRR is greater than the market rate of interest, then the investment in the project is considered viable and worthy.

### 3.4 Sensitivity analysis

Sensitivity analysis involves changing of one or more values in net present value (NPV) equation and recalculating the NPV [8]. This analysis provides better insight into the profitability of investment. Under these three cases are considered

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Case I: Returns decreased by 10 per cent

Case II: Costs increased by 10 per cent

Case III: Returns decreased by 10 per cent and Costs increased by 10 per cent simultaneously

#### 4. RESULTS AND DISCUSSION

##### 4.1 Economic viability of layer farms

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The results for economic viability of different sized layer farms are presented in Table. 1 and entire calculations presented in Appendix. The net present value of large farms at 12% discount rate is Rs. 3,22,61,595 whereas for medium and small farms is Rs. 70,85,828 and Rs. 22,42,560 respectively. The BCR for small, medium and large farms are 1.19, 1.23 and 1.27, respectively. The net present worth of small, medium and large layer farms at 16% discount rate are Rs.2,54,53,888. Rs.43,39,808 and Rs.17,15,595 respectively and the corresponding BC-ratios are 1.17,1.22 and 1.25 respectively. The Net Present Worth is highest for large farms followed by medium and small farms at both discount rates. The net present values for all the farms are positive at both 12 and 16% discount rates which in turn prove the economic viability of farms. The Benefit-Cost Ratio was positively related with farm-size and the large farms were economically more viable. The IRR for highest for large (88.45%) farms followed by medium (73.93%) and small (59.42%) farms. The internal rate of return is higher than that of the discount rate for all sizes of farms which implies that investment is feasible. These results are in conformity with Dinesh and Sharma [5].

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Table 1. Economic viability of layer farms of different sizes

Particulars	Discount rates (%)	
	12	16
	<b>Small farms</b>	
NPV(Rs.)	22,42,560	17,15,595
B-C Ratio	1.19	1.17
IRR (%)	59.42	
	<b>Medium farms</b>	
NPV(Rs.)	70,85,828	43,39,808
B-C Ratio	1.23	1.22
IRR (%)	73.93	
	<b>Large farms</b>	
NPV(Rs.)	3,22,61,595	2,54,53,888
B-C Ratio	1.27	1.25
IRR (%)	88.45	

##### 4.2 Sensitivity analysis

Table 2 presents the results of sensitivity analysis. The calculations are presented in Appendix.

###### 4.2.1 Case I

When the returns were decreased by ten per cent, net present value (NPV) remained positive on all size groups of layer farms at 12 per cent discount rate. The benefit-cost ratio

was more than one on all farms. The same trend was discernable even at 16 per cent discount rate. The internal rate of return (IRR) worked out to 31.58, 42.92 and 54.46 per cent on small, medium and large layer farms. This indicates that all the three size groups of layer farms are financially viable under this situation i.e., even when the net returns were decreased by 10 per cent.

#### **4.4.2 Case II**

When the costs were increased by 10 per cent, the net present value (NPV) was Rs.10,70,435 on small farms, Rs.31,62,513 on medium farms and Rs.2,02,41,964 on large farms at 12 per cent discount rate. The benefit-cost ratio was 1.08, 1.12 and 1.15 on small, medium and large farms respectively. At 16 per cent discount rate also, NPV was positive and B-C ratio, more than one on all size groups. The internal rate of return (IRR) was 34.01 per cent on small farms, 45.98 per cent on medium farms and 57.51 per cent on large farms. Hence, under this situation also, all the three size groups of layer farms are economically viable.

#### **4.2.3 Case III**

When the returns were decreased by 10 per cent and Costs increased by 10 per cent simultaneously, large and medium layer farms remained financially viable while small farms became non-viable at 12 per cent discount rate as evidenced by the indices of economic viability. The NPV on small farms became negative (Rs. -3,25,946), BCR, less than one (0.97) and IRR less than discount rate of 12 per cent (4.53 per cent). At 16 per cent discount rate, small as well as medium layer farms became economically non- viable. Their NPV became negative, BCR less than one and IRR less than discount rate of 16 per cent. However, the large farms continued to be financially sound even under this situation. Their NPV was Rs.28,30,286, BCR, 1.03 and IRR, 24.34 per cent.

Thus, it may be concluded that investment in layer farming is financially viable on all categories of layer farms. But the small layer farms were highly sensitive to increase in costs and decrease in net returns followed by medium farms. On the basis of NPV, BCR and IRR, investment in layer farming was found to be most profitable in large farms followed by medium and small farms. This was due to the fact that the benefits per bird were highest and cost of production was lowest on large farms. In contrast, the benefits per bird were lowest and cost per bird was highest on small farms. These results are in agreement with the results of financial analysis reported by Singh et al [4].

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**Table 2. Results of Sensitivity analysis**

Particulars	Discount rate 12%			Discount rate 16%		
	Small	Medium	Large	Small	Medium	Large
<b>Case I</b>						
<b>NPV(Rs.)</b>	8,46,179	26,05,984	1,70,15,805	5,63,296	18,96,386	1,28,69,393
<b>B-C Ratio</b>	1.07	1.11	1.14	1.06	1.09	1.13
<b>IRR (%)</b>	31.58	42.92	54.46			
<b>Case II</b>						
<b>NPV(Rs.)</b>	10,70,435	31,62,513	2,02,41,964	7,34,856	23,30,367	1,54,14,781
<b>B-C Ratio</b>	1.08	1.12	1.15	1.07	1.11	1.14
<b>IRR (%)</b>	34.01	45.98	57.51			

Case III						
<b>NPV(Rs.)</b>	-3,25,946	2,03,205	49,96,174	-4,17,443	-1,13,054	28,30,286
<b>B-C Ratio</b>	0.97	1.01	1.04	0.96	0.99	1.03
<b>IRR (%)</b>	4.53	14.99	24.34			

Case I: Returns decreased by 10 per cent

Case II: Costs increased by 10 per cent

Case III: Returns decreased by 10 per cent and Costs increased by 10 per cent simultaneously

#### 4. CONCLUSION

The Net Present Worth is highest for large farms followed by medium and small farms at both discount rates which in turn prove the economic viability of farms. The Benefit-Cost Ratio was positively related with farm-size and the large farms were economically more viable. The internal rate of return is higher than that of the discount rate for all sizes of farms which implies that investment is feasible. Even though the returns are decreased by 10% (Case I) or Costs increased by 10% (Case II) the small, medium and large poultry layer farms are economically feasible at both 12% and 16% discount rates as NPV is positive and BCR is greater than 1. But if the returns are decreased by 10% and Costs increased by 10% (Case III) the small farms become financially infeasible at both discount rates whereas medium farms become financially infeasible at 16% discount rate only. The large layer farms are economically feasible at both discount rates if the returns are decreased by 10% and Costs increased by 10% (Case III). On the basis of NPV, BCR and IRR, investment in layer farming was found to be most profitable in large farms followed by medium and small farms. This was due to the fact that the benefits per bird were highest and cost of production was lowest on large farms. Thus, poultry layer farming is a profitable business and there is still scope for its growth due to increase in demand for poultry products.

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#### REFERENCES

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#### APPENDIX

##### 1. ESTIMATION OF NPW AND BCR AT 12 PER CENT DISCOUNT RATE

### SMALL FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	909000	0	-909000	0.892857	811607.1	0	-811607
2	1958829	2459198	500369.2	0.797194	1561566	1960458	398891.3
3	2073259	2488250	414991.3	0.711178	1475705	1771087	295382.6
4	2212600	2890030	677429.7	0.635518	1406147	1836666	430518.8
5	2286225	2862535	576309.7	0.567427	1297266	1624279	327013.6
6	2383328	3040416	657087.9	0.506631	1207468	1540369	332901.2
7	2432094	3145952	713857.8	0.452349	1100156	1423069	322913
8	2507744	3293720	785976	0.403883	1012836	1330278	317442.5
9	2666256	3551268	885012.1	0.36061	961478.6	1280623	319144.2
10	2754961	3717650	962689.3	0.321973	887023.7	1196984	309960.2
<b>Total</b>	<b>NPV=2242560</b>				<b>11721253</b>	<b>13963814</b>	<b>2242560</b>
		<b>BCR=1.91</b>					

### MEDIUM FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	1703000	0	-1703000	0.892857	1520536	0	-1520536
2	4158004	5373986	1215982	0.797194	3314735	4284109	969373.6
3	4293420	5295975	1002555	0.711178	3055972	3769570	713598.6
4	4480891	6009076	1528184	0.635518	2847687	3818876	971188.8
5	4657671	5987855	1330184	0.567427	2642888	3397670	754782.1
6	4864075	6371088	1507013	0.506631	2464292	3227791	763499.9
7	5040382	6698537	1658155	0.452349	2280013	3030078	750064.9
8	5265565	7108620	1843055	0.403883	2126673	2871052	744378.9
9	5461750	7468959	2007209	0.36061	1969562	2693381	723819.8
10	5607404	7766346	2158941	0.321973	1805434	2500555	695121.3
<b>Total</b>	<b>NPV=7085828</b>				<b>24027792</b>	<b>29593084</b>	<b>7085828</b>
		<b>BCR=1.23</b>					

### LARGE FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	7886250	0	-7886250	0.892857	7041295	0	-7041295
2	20719902	27373808	6653905	0.797194	16517779	21822232	5304453
3	21218067	27290740	6072673	0.711178	15102601	19425010	4322409
4	22638508	31040233	8401725	0.635518	14387181	19726629	5339448
5	23521174	30906565	7385391	0.567427	13346546	17537215	4190669
6	24545506	32852736	8307230	0.506631	12435517	16644218	4208701
7	25499658	34626973	9127315	0.452349	11534750	15663484	4128734
8	26658388	36768044	10109657	0.403883	10766876	14849996	4083121
9	27432359	38307589	10875230	0.36061	9892384	13814101	3921717
10	28484912	40298435	11813522	0.321973	9171379	12975017	3803638
<b>Total</b>	<b>NPV=32261595</b>				<b>120196310</b>	<b>152457900</b>	<b>32261595</b>
		<b>BCR=1.27</b>					



## 2. ESTIMATION OF NPW AND BCR AT 16 PER CENT DISCOUNT RATE

### SMALL FARMS

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	909000	0	-909000	0.862069	783620.7	0	-783621
2	1958829	2459198	500369.2	0.743163	1455729	1827585	371855.7
3	2073259	2488250	414991.3	0.640658	1328249	1594116	265867.2
4	2212600	2890030	677429.7	0.552291	1221999	1596138	374138.6
5	2286225	2862535	576309.7	0.476113	1088501	1362890	274388.7
6	2383328	3040416	657087.9	0.410442	978218.5	1247915	269696.7
7	2432094	3145952	713857.8	0.35383	860546.7	1113131	252584
8	2507744	3293720	785976	0.305025	764925.8	1004668	239742.7
9	2666256	3551268	885012.1	0.262953	701100	933816.5	232716.5
10	2754961	3717650	962689.3	0.226684	624504.5	842730.3	218225.8
<b>Total</b>					<b>9807395</b>	<b>11522990</b>	<b>1715595</b>
<b>NPV=1715595</b>		<b>BCR=1.17</b>					

### MEDIUM FARMS

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	1703000	0	-1703000	0.862069	1468103	0	-1468103
2	4158004	5373986	1215982	0.743163	3090074	3993747	903672.7
3	4293420	5295975	1002555	0.640658	2750612	3392907	642294.6
4	4480891	6009076	1528184	0.552291	2474756	3318759	844003
5	4657671	5987855	1330184	0.476113	2217578	2850896	633317.9
6	4864075	6371088	1507013	0.410442	1996422	2614964	618541.8
7	5040382	6698537	1658155	0.35383	1783436	2370140	586704.2
8	5265565	7108620	1843055	0.305025	1606131	2168310	562178.7
9	5461750	7468959	2007209	0.262953	1436183	1963985	527801.6
10	5607404	7766346	2158941	0.226684	1271107	1760503	489396.8
<b>Total</b>					<b>20094403</b>	<b>24434211</b>	<b>4339808</b>
<b>NPV=4339808</b>		<b>BCR=1.22</b>					

### LARGE FARMS

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	7886250	0	-7886250	0.862069	6798491	0	-6798491
2	20719902	27373808	6653905	0.743163	15398262	20343199	4944936
3	21218067	27290740	6072673	0.640658	13593517	17484022	3890505
4	22638508	31040233	8401725	0.552291	12503046	17143244	4640198
5	23521174	30906565	7385391	0.476113	11198737	14715018	3516281
6	24545506	32852736	8307230	0.410442	10074513	13484151	3409638
7	25499658	34626973	9127315	0.35383	9022532	12252046	3229514
8	26658388	36768044	10109657	0.305025	8131487	11215189	3083702
9	27432359	38307589	10875230	0.262953	7213421	10073095	2859674

10	28484912	40298435	11813522	0.226684	6457062	9134994	2677932
<b>Total</b>					<b>100391070</b>	<b>125844960</b>	<b>25453888</b>
<b>NPV=25453888</b>		<b>BCR=1.25</b>					

### 3. ESTIMATION OF INTERNAL RATE OF RETURNS

SMALL FARMS						
Years	Net benefits	Discount factor (50%)	NPW at discount factor 50%	Discount factor (60%)	NPW at discount factor 60%	
1	-909000	0.666667	-606000	0.625	-568125	
2	500369	0.444444	222386.2	0.390625	195456.6	
3	414991	0.296296	122960.3	0.244141	101316.2	
4	677430	0.197531	133813.3	0.152588	103367.6	
5	576310	0.131687	75892.67	0.095367	54961.2	
6	657088	0.087791	57686.74	0.059605	39165.5	
7	713858	0.058528	41780.44	0.037253	26593.28	
8	785976	0.039018	30667.56	0.023283	18299.93	
9	885012	0.026012	23021.19	0.014552	12878.62	
10	962689	0.017342	16694.5	0.009095	8755.605	
<b>Total</b>			<b>118903</b>		<b>-7330.44</b>	
<b>IRR=59.42%</b>						

MEDIUM FARMS						
Years	Net benefits	Discount factor (65%)	NPW at discount factor 65%	Discount factor (75%)	NPW at discount factor 75%	
1	-1703000	0.606061	-1032121	0.571429	-973143	
2	1215982	0.367309	446641.7	0.326531	397055.3	
3	1002555	0.222612	223180.6	0.186589	187065.7	
4	1528185	0.134916	206177	0.106622	162938.5	
5	1330184	0.081767	108765.7	0.060927	81044.11	
6	1507013	0.049556	74681.55	0.034815	52467.3	
7	1658155	0.030034	49800.94	0.019895	32988.21	
8	1843055	0.018202	33548.01	0.011368	20952.41	
9	2007209	0.011032	22143.03	0.006496	13039.18	
10	2158942	0.006686	14434.49	0.003712	8014.206	
<b>Total</b>			<b>147251.7</b>		<b>-17577.9</b>	
<b>IRR=73.93%</b>						

LARGE FARMS						
Years	Net benefits	Discount factor (80%)	NPW at discount factor 80%	Discount factor (90%)	NPW at discount factor 90%	
1	-7886250	0.555556	-4381250	0.526316	-4150658	
2	6653906	0.308642	2053675	0.277008	1843187	
3	6072673	0.171468	1041268	0.145794	885358.4	
4	8401725	0.09526	800347.2	0.076734	644694.6	
5	7385391	0.052922	390850.8	0.040386	298267.2	

6	8307230	0.029401	244242.5	0.021256	176577.2
7	9127315	0.016334	149085.5	0.011187	102109.9
8	10109656	0.009074	91739.49	0.005888	59526.12
9	10875230	0.005041	54825.92	0.003099	33702.03
10	11813523	0.002801	33086.77	0.001631	19268.3
<b>Total</b>			<b>477870.5</b>		<b>-87966.9</b>

IRR=88.45%

**4. SENSITIVITY ANALYSIS FOR NPV AND BCR AT 16 PER CENT DISCOUNT RATE WITH 10 PER CENT INCREASE IN COSTS**

**SMALL FARMS**

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	999900	0	-999900	0.862069	861982.8	0	-861983
2	2154712	2459198	304486.3	0.743163	1601302	1827585	226282.9
3	2280585	2488250	207665.4	0.640658	1461074	1594116	133042.4
4	2433860	2890030	456169.7	0.552291	1344199	1596138	251938.4
5	2514848	2862535	347687.1	0.476113	1197352	1362890	165538.4
6	2621661	3040416	418755.1	0.410442	1076040	1247915	171874.8
7	2675303	3145952	470648.8	0.35383	946601.3	1113131	166529.5
8	2758519	3293720	535201.2	0.305025	841418.5	1004668	163250
9	2932881	3551268	618386.5	0.262953	771209.9	933816.5	162606.6
10	3030457	3717650	687193	0.226684	686954.9	842730.3	155775.4
<b>Total</b>					<b>10788135</b>	<b>11522990</b>	<b>734855.6</b>

NPV=734855.6      BCR=1.07

**MEDIUM FARMS**

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	1873300	0	-1873300	0.862069	1614914	0	-1614914
2	4573804	5373986	800181.8	0.743163	3399082	3993747	594665.4
3	4722762	5295975	573212.6	0.640658	3025674	3392907	367233
4	4928980	6009076	1080095	0.552291	2722232	3318759	596527
5	5123438	5987855	864416.8	0.476113	2439336	2850896	411560.1
6	5350482	6371088	1020606	0.410442	2196064	2614964	418899.8
7	5544420	6698537	1154116	0.35383	1961780	2370140	408360.5
8	5792122	7108620	1316498	0.305025	1766745	2168310	401565.4
9	6007925	7468959	1461034	0.262953	1579802	1963985	384183.3
10	6168145	7766346	1598201	0.226684	1398217	1760503	362285.9
<b>Total</b>					<b>22103844</b>	<b>24434211</b>	<b>2330367</b>

NPV=2330367      BCR=1.11

**LARGE FARMS**

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	8674875	0	8674875	0.862069	7478341	0	-7478341

2	22791892	27373808	4581915	0.743163	16938089	20343198	3405109
3	23339873	27290740	3950867	0.640658	14952869	17484022	2531153
4	24902359	31040233	6137874	0.552291	13753351	17143244	3389893
5	25873291	30906565	5033274	0.476113	12318611	14715018	2396407
6	27000056	32852736	5852680	0.410442	11081964	13484151	2402187
7	28049624	34626973	6577349	0.35383	9924785	12252045	2327260
8	29324226	36768044	7443818	0.305025	8944636	11215190	2270554
9	30175595	38307589	8131994	0.262953	7934763	10073095	2138332
10	31333404	40298435	8965031	0.226684	7102769	9134994	2032226
<b>Total</b>					<b>110430180</b>	<b>125844960</b>	<b>15414781</b>
<b>NPV=15414781</b>							<b>BCR=1.14</b>

**5. SENSITIVITY ANALYSIS FOR NPV AND BCR AT 16 PER CENT DISCOUNT RATE WITH 10 PER CENT DECREASE IN RETURNS  
SMALL FARMS**

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	909000	0	-909000	0.862069	783620.7	0	-783621
2	1958829	2213278	254449.4	0.743163	1455729	1644826	189097.3
3	2073259	2239425	166166.3	0.640658	1328249	1434705	106455.7
4	2212600	2601027	388426.7	0.552291	1221999	1436524	214524.6
5	2286225	2576282	290056.2	0.476113	1088502	1226601	138099.5
6	2383328	2736374	353046.3	0.410442	978218.6	1123124	144905.1
7	2432094	2831356	399262.7	0.35383	860546.6	1001818	141270.9
8	2507744	2964348	456604	0.305025	764925.9	904201.7	139275.8
9	2666256	3196141	529885.3	0.262953	701099.9	840434.9	139334.9
10	2754961	3345885	590924.3	0.226684	624504.5	758457.3	133952.8
<b>Total</b>					<b>9807395</b>	<b>10370691</b>	<b>563296.1</b>
<b>NPV=563296.1</b>							<b>BCR=1.06</b>

**MEDIUM FARMS**

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	1703000	0	-1703000	0.862069	1468103	0	-1468103
2	4158004	4836588	678583.6	0.743163	3090074	3594372	504298.2
3	4293420	4766378	472957.1	0.640658	2750613	3053616	303003.6
4	4480891	5408168	927276.9	0.552291	2474756	2986883	512126.8
5	4657671	5389070	731398.4	0.476113	2217578	2565806	348228.3
6	4864075	5733979	869904.6	0.410442	1996422	2353467	357045.6
7	5040382	6028683	988301	0.35383	1783436	2133126	349690.1
8	5265565	6397758	1132193	0.305025	1606131	1951479	345347.6
9	5461750	6722063	1260313	0.262953	1436183	1767587	331403.1
10	5607404	6989711	1382307	0.226684	1271107	1584453	313346.2
<b>Total</b>					<b>20094404</b>	<b>21990790</b>	<b>1896386</b>
<b>NPV=1896386</b>							<b>BCR=1.09</b>

**LARGE FARMS**

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	7886250	0	7886250	0.862069	6798491	0	-6798491
2	20719902	24636427	3916525	0.743163	15398263	18308878	2910616
3	21218067	24561666	3343599	0.640658	13593517	15735620	2142103
4	22638508	27936210	5297702	0.552291	12503046	15428920	2925874
5	23521174	27815908	4294734	0.476113	11198737	13243516	2044779
6	24545506	29567462	5021957	0.410442	10074513	12135736	2061223
7	25499658	31164275	5664617	0.35383	9022532	11026841	2004309
8	26658388	33091240	6432852	0.305025	8131487	10093671	1962184
9	27432359	34476830	7044471	0.262953	7213421	9065785	1852365
10	28484912	36268591	7783679	0.226684	6457063	8221495	1764432
<b>Total</b>					<b>100391070</b>	<b>113260460</b>	<b>12869393</b>
<b>NPV=12869393</b>		<b>BCR=1.13</b>					

**6. SENSITIVITY ANALYSIS FOR NPW AND BCR AT 16 PER CENT DISCOUNT RATE WITH 10 PER CENT INCREASE IN COSTS AND 10 PER CENT DECREASE IN RETURNS**

**SMALL FARMS**

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	999900	0	-999900	0.862069	861982.8	0	-861983
2	2154712	2213278	58566.51	0.743163	1601302	1644826	43524.46
3	2280585	2239425	-41159.6	0.640658	1461074	1434705	-26369.2
4	2433860	2601027	167166.7	0.552291	1344199	1436524	92324.66
5	2514848	2576282	61433.61	0.476113	1197352	1226601	29249.34
6	2621661	2736374	114713.5	0.410442	1076040	1123124	47083.25
7	2675303	2831356	156053.3	0.35383	946601.3	1001818	55216.26
8	2758519	2964348	205829.6	0.305025	841418.5	904201.7	62783.25
9	2932881	3196141	263259.7	0.262953	771209.9	840434.9	69224.93
10	3030457	3345885	315428.2	0.226684	686954.9	758457.3	71502.4
<b>Total</b>					<b>10788135</b>	<b>10370691</b>	<b>-417443</b>
<b>NPV=-417443</b>		<b>BCR=0.96</b>					

**MEDIUM FARMS**

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	1873300	0	-1873300	0.862069	1614914	0	-1614914
2	4573804	4836588	262783.2	0.743163	3399082	3594372	195290.7
3	4722762	4766378	43615.06	0.640658	3025674	3053616	27942.32
4	4928980	5408168	479187.8	0.552291	2722232	2986883	264651.1
5	5123438	5389070	265631.3	0.476113	2439336	2565806	126470.5
6	5350482	5733979	383497.1	0.410442	2196064	2353467	157403.4
7	5544420	6028683	484262.8	0.35383	1961780	2133126	171346.5
8	5792122	6397758	605636.2	0.305025	1766745	1951479	184734.4
9	6007925	6722063	714138.3	0.262953	1579802	1767587	187784.8

10	6168145	6989711	821566.1	0.226684	1398217	1584453	186235.6
<b>Total</b>					<b>22103844</b>	<b>21990790</b>	<b>-113054</b>
<b>NPV=-113054</b>		<b>BCR=0.99</b>					

#### LARGE FARMS

Years	Costs	Benefits	Net benefits	Discount factor (16%)	Present worth of costs	Present worth of benefits	Net present worth
1	8674875	0	8674875	0.862069	7478341	0	-7478341
2	22791892	24636427	1844534	0.743163	16938089	18308878	1370790
3	23339873	24561666	1221793	0.640658	14952869	15735620	782750.8
4	24902359	27936210	3033851	0.552291	13753351	15428920	1675569
5	25873291	27815908	1942617	0.476113	12318611	13243516	924905.3
6	27000056	29567462	2567406	0.410442	11081964	12135736	1053772
7	28049624	31164275	3114652	0.35383	9924785	11026841	1102056
8	29324226	33091240	3767014	0.305025	8944636	10093671	1149035
9	30175595	34476830	4301235	0.262953	7934763	9065785	1131023
10	31333404	36268591	4935188	0.226684	7102769	8221495	1118726
<b>Total</b>					<b>110430180</b>	<b>11326046</b>	<b>2830286</b>
<b>NPV=2830286</b>		<b>BCR=1.03</b>					

#### 7. SENSITIVITY ANALYSIS FOR NPW AND BCR AT 12 PER CENT DISCOUNT RATE WITH 10 PER CENT INCREASE IN COSTS

##### SMALL FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	999900	0	-999900	0.892857	892767.9	0	-892768
2	2154712	2459198	304486.3	0.797194	1717723	1960458	242734.6
3	2280585	2488250	207665.4	0.711178	1623275	1771087	147812.1
4	2433860	2890030	456169.7	0.635518	1546762	1836666	289904.1
5	2514848	2862535	347687.1	0.567427	1426992	1624279	197287
6	2621661	3040416	418755.1	0.506631	1328215	1540369	212154.3
7	2675303	3145952	470648.4	0.452349	1210171	1423069	212897.5
8	2758519	3293720	535201.6	0.403883	1114119	1330278	216158.9
9	2932881	3551268	618386.5	0.36061	1057626	1280623	222996.4
10	3030457	3717650	687193.2	0.321973	975726	1196984	221257.8
<b>Total</b>					<b>12893379</b>	<b>13963814</b>	<b>1070435</b>
<b>NPV=1070435</b>		<b>BCR=1.08</b>					

##### MEDIUM FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	1873300	0	-1873300	0.892857	1672589	0	-1672589
2	4573804	5373986	800181.8	0.797194	3646209	4284109	637900.1
3	4722762	5295975	573212.6	0.711178	3361569	3769570	408001.4
4	4928980	6009076	1080095	0.635518	3132456	3818876	686420.1
5	5123438	5987855	864416.8	0.567427	2907177	3397670	490493.3
6	5350482	6371088	1020606	0.506631	2710721	3227791	517070.7

7	5544420	6698537	1154116	0.452349	2508014	3030078	522063.7
8	5792122	7108620	1316498	0.403883	2339341	2871052	531711.5
9	6007925	7468959	1461034	0.36061	2166518	2693381	526863.6
10	6168145	7766346	1598201	0.321973	1985978	2500555	514577.8
<b>Total</b>					<b>26430571</b>	<b>29593084</b>	<b>3162513</b>

**NPV=3162513      BCR=1.12**

#### LARGE FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	8674875	0	8674875	0.892857	7745424	0	-7745424
2	22791892	27373808	4581915	0.797194	18169557	21822232	3652675
3	23339873	27290740	3950867	0.71178	16612861	19425010	2812149
4	24902359	31040233	6137874	0.635518	15825899	19726629	3900730
5	25873291	30906565	5033274	0.567427	14681200	17537215	2856015
6	27000056	32852736	5852680	0.506631	13679069	16644218	2965150
7	28049624	34626973	6577349	0.452349	12688225	15663484	2975259
8	29324226	36768044	7443818	0.403883	11843563	14849996	3006433
9	30175595	38307589	8131994	0.36061	10881622	13814101	2932479
10	31333404	40298435	8965031	0.321973	10088517	12975017	2886500
<b>Total</b>					<b>132215940</b>	<b>152457900</b>	<b>20241964</b>

**NPV=20241964      BCR=1.15**

#### 8. SENSITIVITY ANALYSIS FOR NPW AND BCR AT 12 PER CENT DISCOUNT RATE WITH 10 PER CENT DECREASE IN RETURNS

##### SMALL FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	909000	0	-909000	0.892857	811607.1	0	-811607
2	1958829	2213278	254449.4	0.797194	1561566	1764412	202845.5
3	2073259	2239425	166166.3	0.71178	1475705	1593978	118273.9
4	2212600	2601027	388426.7	0.635518	1406147	1653000	246852.2
5	2286225	2576282	290056.2	0.567427	1297266	1461851	164585.6
6	2383328	2736374	353046.3	0.506631	1207468	1386332	178864.2
7	2432094	2831356	399262.7	0.452349	1100156	1280762	180606.2
8	2507744	2964348	456604	0.403883	1012836	1197251	184414.7
9	2666256	3196141	529885.3	0.36061	961478.6	1152561	191082
10	2754961	3345885	590924.3	0.321973	887023.7	1077285	190261.8
<b>Total</b>					<b>11721253</b>	<b>12567432</b>	<b>846178.9</b>

**NPV=846178.9      BCR=1.07**

##### MEDIUM FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	1703000	0	-1703000	0.892857	1520536	0	-1520536
2	4158004	4836588	678583.6	0.797194	3314735	3855698	540962.7

3	4293420	4766378	472957.1	0.71178	3055972	3392613	336641.5
4	4480891	5408168	927276.9	0.635518	2847687	3436989	589301.2
5	4657671	5389070	731398.4	0.567427	2642888	3057903	415015.1
6	4864075	5733979	869904.6	0.506631	2464292	2905012	440720.7
7	5040382	6028683	988301	0.452349	2280013	2727070	447057.2
8	5265565	6397758	1132193	0.403883	2126673	2583947	457273.6
9	5461750	6722063	1260313	0.36061	1969562	2424043	454481.6
10	5607404	6989711	1382307	0.321973	1805434	2250500	445065.7
<b>Total</b>					<b>24027792</b>	<b>26633775</b>	<b>2605984</b>

**NPV=2605984 BCR=1.11**

#### LARGE FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	7886250	0	7886250	0.892857	7041295	0	-7041295
2	20719902	24636427	3916525	0.797194	16517779	19640009	3122229
3	21218067	24561666	3343599	0.71178	15102601	17482509	2379908
4	22638508	27936210	5297702	0.635518	14387181	17753966	3366785
5	23521174	27815908	4294734	0.567427	13346546	15783493	2436948
6	24545506	29567462	5021957	0.506631	12435517	14979797	2544280
7	25499658	31164275	5664617	0.452349	11534750	14097136	2562385
8	26658388	33091240	6432852	0.403883	10766876	13364997	2598121
9	27432359	34476830	7044471	0.36061	9892384	12432691	2540307
10	28484912	36268591	7783679	0.321973	9171379	11677516	2506136
<b>Total</b>					<b>120196310</b>	<b>137212110</b>	<b>17015805</b>

**NPV=17015805 BCR=1.14**

#### 9. SENSITIVITY ANALYSIS FOR NPW AND BCR AT 12 PER CENT DISCOUNT RATE WITH 10 PER CENT INCREASE IN COSTS AND 10 PER CENT DECREASE IN RETURNS

##### SMALL FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	999900	0	-999900	0.892857	892767.9	0	-892768
2	2154712	2213278	58566.51	0.797194	1717723	1764412	46688.86
3	2280585	2239425	-41159.6	0.71178	1623275	1593978	-29296.6
4	2433860	2601027	167166.7	0.635518	1546762	1653000	106237.4
5	2514848	2576282	61433.61	0.567427	1426992	1461851	34859.08
6	2621661	2736374	114713.5	0.506631	1328215	1386332	58117.41
7	2675303	2831356	156053.3	0.452349	1210171	1280762	70590.58
8	2758519	2964348	205829.6	0.403883	1114119	1197251	83131.1
9	2932881	3196141	263259.7	0.36061	1057626	1152561	94934.09
10	3030457	3345885	315428.2	0.321973	975726	1077285	101559.4
<b>Total</b>					<b>12893379</b>	<b>12567432</b>	<b>-325946</b>

**NPV=-325946 BCR=0.97**

##### MEDIUM FARMS

Years	Costs	Benefits	Net	Discount	Present	Present	Net
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			benefits	factor (12%)	worth of costs	worth of benefits	present worth
1	1873300	0	-1873300	0.892857	1672589	0	-1672589
2	4573804	4836588	262783.2	0.797194	3646209	3855698	209489.2
3	4722762	4766378	43615.06	0.711178	3361569	3392613	31044.34
4	4928980	5408168	479187.8	0.635518	3132456	3436989	304532.5
5	5123438	5389070	265631.3	0.567427	2907177	3057903	150726.3
6	5350482	5733979	383497.1	0.506631	2710721	2905012	194291.6
7	5544420	6028683	484262.8	0.452349	2508014	2727070	219055.9
8	5792122	6397758	605636.2	0.403883	2339341	2583947	244606.3
9	6007925	6722063	714138.3	0.36061	2166518	2424043	257525.4
10	6168145	6989711	821566.1	0.321973	1985978	2250500	264522.3
<b>Total</b>					<b>26430571</b>	<b>26633775</b>	<b>203204.5</b>
<b>NPV=203204.5</b>							<b>BCR=1.01</b>

#### LARGE FARMS

Years	Costs	Benefits	Net benefits	Discount factor (12%)	Present worth of costs	Present worth of benefits	Net present worth
1	8674875	0	8674875	0.892857	7745424	0	-7745424
2	22791892	24636427	1844534	0.797194	18169557	19640009	1470452
3	23339873	24561666	1221793	0.711178	16612861	17482509	869647.8
4	24902359	27936210	3033851	0.635518	15825899	17753966	1928067
5	25873291	27815908	1942617	0.567427	14681200	15783493	1102293
6	27000056	29567462	2567406	0.506631	13679069	14979797	1300728
7	28049624	31164275	3114652	0.452349	12688225	14097136	1408910
8	29324226	33091240	3767014	0.403883	11843563	13364997	1521434
9	30175595	34476830	4301235	0.36061	10881622	12432691	1551069
10	31333404	36268591	4935188	0.321973	10088517	11677516	1588998
<b>Total</b>					<b>132215940</b>	<b>137212110</b>	<b>4996174</b>
<b>NPV=4996174</b>							<b>BCR=1.04</b>

#### 10. ESTIMATION OF INTERNAL RATE OF RETURNS WHEN COSTS INCREASED BY 10 PER CENT

#### SMALL FARMS

Years	Net benefits	Discount factor (30%)	NPW at discount factor 30%	Discount factor (35%)	NPW at discount factor 35%
1	-999900	0.769231	-769154	0.740741	-740667
2	304486.3	0.591716	180169.4	0.548697	167070.7
3	207665.4	0.455166	94522.25	0.406442	84403.95
4	456169.7	0.350128	159717.7	0.301068	137338.2
5	347687.1	0.269329	93642.25	0.223014	77538.92
6	418755.1	0.207176	86756.09	0.165195	69176.32
7	470648.4	0.159366	75005.51	0.122367	57591.75
8	535201.6	0.122589	65610.08	0.090642	48511.78
9	618386.5	0.0943	58313.6	0.067142	41519.88
10	687193.2	0.072538	49847.72	0.049735	34177.57
<b>Total</b>			<b>94430.74</b>		<b>-23337.6</b>

IRR=34.01%

<b>MEDIUM FARMS</b>					
Years	Net benefits	Discount factor (40%)	NPW at discount factor 40%	Discount factor (50%)	NPW at discount factor 50%
1	-1873300	0.714286	-1338071	0.666667	-1248867
2	800181.8	0.510204	408256	0.444444	355636.4
3	573212.6	0.364431	208896.7	0.296296	169840.8
4	1080095	0.260308	281157.7	0.197531	213352.2
5	864416.8	0.185934	160724.8	0.131687	113832.7
6	1020606	0.13281	135547	0.087791	89600.52
7	1154116	0.094865	109484.7	0.058528	67547.74
8	1316498	0.06776	89206.39	0.039018	51367.71
9	1461034	0.0484	70714.43	0.026012	38004.85
10	1598201	0.034572	55252.38	0.017342	27715.24
<b>Total</b>			<b>181168.7</b>		<b>-121969</b>

IRR=45.98%

<b>LARGE FARMS</b>					
Years	Net benefits	Discount factor (50%)	NPW at discount factor 50%	Discount factor (60%)	NPW at discount factor 60%
1	-8674875	0.666667	-5783250	0.625	-5421797
2	4581915	0.444444	2036407	0.390625	1789811
3	3950867	0.296296	1170627	0.244141	964567
4	6137874	0.197531	1212420	0.152588	936565.3
5	5033274	0.131687	662817.9	0.095367	480010.4
6	5852680	0.087791	513815.5	0.059605	348846.9
7	6577349	0.058528	384956.9	0.037253	245025.3
8	7443818	0.039018	290446.2	0.023283	173314.9
9	8131994	0.026012	211531.8	0.014552	118336.1
10	8965031	0.017342	155467.4	0.009095	81536.48
<b>Total</b>			<b>855239.2</b>		<b>-283784</b>

IRR=57.51%

**11. ESTIMATION OF INTERNAL RATE OF RETURNS WHEN RETURNS DECREASED BY 10 PER CENT**

<b>SMALL FARMS</b>					
Years	Net benefits	Discount factor (30%)	NPW at discount factor 30%	Discount factor (40%)	NPW at discount factor 40%
1	-909000	0.769231	-699231	0.740741	-673333
2	254449.4	0.591716	150561.8	0.548697	139615.6
3	166166.3	0.455166	75633.25	0.406442	67536.96
4	388426.7	0.350128	135999	0.301068	116942.9
5	290056.2	0.269329	78120.55	0.223014	64686.44
6	353046.3	0.207176	73142.79	0.165195	58321.55
7	399262.7	0.159366	63629.02	0.122367	48856.5
8	456604	0.122589	55974.84	0.090642	41387.53

9	529885.3	0.0943	49967.97	0.067142	35577.71
10	590924.3	0.072538	42864.55	0.049735	29389.63
<b>Total</b>			<b>26662.96</b>		<b>-71018.5</b>

**IRR=31.58%**

**MEDIUM FARMS**

Years	Net benefits	Discount factor (35%)	NPW at discount factor 35%	Discount factor (45%)	NPW at discount factor 45%
1	-1703000	0.740741	-1261481	0.689655	-1174483
2	678583.6	0.548697	372336.7	0.475624	322750.8
3	472957.1	0.406442	192229.7	0.328017	155137.8
4	927276.9	0.301068	279173.6	0.226218	209767.1
5	731398.4	0.223014	163111.7	0.156013	114107.4
6	869904.6	0.165195	143704	0.107595	93597.36
7	988301	0.122367	120935.2	0.074203	73335.32
8	1132193	0.090642	102624.3	0.051175	57939.71
9	1260313	0.067142	84620.31	0.035293	44480.18
10	1382307	0.049735	68749.05	0.02434	33645.3
<b>Total</b>			<b>266003.1</b>		<b>-69721.7</b>

**IRR=42.92%**

**LARGE FARMS**

Years	Net benefits	Discount factor (50%)	NPW at discount factor 50%	Discount factor (60%)	NPW at discount factor 60%
1	-7886250	0.666667	-5257500	0.625	-4928906
2	3916525	0.444444	1740678	0.390625	1529892
3	3343599	0.296296	990696.1	0.244141	816308.4
4	5297702	0.197531	1046460	0.152588	808365.2
5	4294734	0.131687	565561.7	0.095367	409577.8
6	5021957	0.087791	440885.1	0.059605	299331.9
7	5664617	0.058528	331536.8	0.037253	211023.4
8	6432852	0.039018	250999.9	0.023283	149776.5
9	7044471	0.026012	183242.9	0.014552	102510.5
10	7783679	0.017342	134980.9	0.009095	70792.15
<b>Total</b>			<b>427540.6</b>		<b>-531328</b>

**IRR=54.46%**

**12. ESTIMATION OF INTERNAL RATE OF RETURNS WHEN COSTS INCREASED BY 10 PER CENT AND RETURNS DECREASED BY 10 PER CENT**

**SMALL FARMS**

Years	Net benefits	Discount factor (2%)	NPW at discount factor 2%	Discount factor (8%)	NPW at discount factor 8%
1	-999900	0.980392	-980294	0.925926	-925833
2	58566.51	0.961169	56292.3	0.857339	50211.34
3	-41159.6	0.942322	-38785.6	0.793832	-32673.8
4	167166.7	0.923845	154436.2	0.73503	122872.5
5	61433.61	0.905731	55642.32	0.680583	41810.69
6	114713.5	0.887971	101862.3	0.63017	72288.94

	7	156053.3	0.87056	135853.8	0.58349	91055.59
	8	205829.6	0.85349	175673.5	0.540269	111203.3
	9	263259.7	0.836755	220283.9	0.500249	131695.4
	10	315428.2	0.820348	258761	0.463193	146104.3
<b>Total</b>				<b>139725.5</b>		<b>-191265</b>

IRR=4.53%

#### MEDIUM FARMS

Years	Net benefits	Discount factor (12%)	NPW at discount factor 12%	Discount factor (20%)	NPW at discount factor 20%
1	-1873300	0.892857	-1672589	0.833333	-1561083
2	262783.2	0.797194	209489.2	0.694444	182488.3
3	43615.06	0.71178	31044.34	0.578704	25240.2
4	479187.8	0.635518	304532.5	0.482253	231089.8
5	265631.3	0.567427	150726.3	0.401878	106751.2
6	383497.1	0.506631	194291.6	0.334898	128432.4
7	484262.8	0.452349	219055.9	0.279082	135148.8
8	605636.2	0.403883	244606.3	0.232568	140851.6
9	714138.3	0.36061	257525.4	0.193807	138404.8
10	821566.1	0.321973	264522.3	0.161506	132687.5
<b>Total</b>			<b>203204.5</b>		<b>-339989</b>

IRR=14.99%

#### LARGE FARMS

Years	Net benefits	Discount factor (20%)	NPW at discount factor 20%	Discount factor (25%)	NPW at discount factor 25%
1	-8674875	0.833333	-7229063	0.8	-6939900
2	1844534	0.694444	1280927	0.64	1180502
3	1221793	0.578704	707055.9	0.512	625557.8
4	3033851	0.482253	1463084	0.4096	1242665
5	1942617	0.401878	780694.3	0.32768	636556.8
6	2567406	0.334898	859819.1	0.262144	673030.1
7	3114652	0.279082	869242.1	0.209715	653189.8
8	3767014	0.232568	876087	0.167772	632000
9	4301235	0.193807	833608.2	0.134218	577302
10	4935188	0.161506	797060.4	0.107374	529911.7
<b>Total</b>			<b>1238515</b>		<b>-189184</b>

IRR=24.34%