

Promotion of Integrated Pest Management Technology in Basmati to boost Diversification in Punjab

-An Impact assessment report

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Impact assessment study of the project
Promotion of Integrated Pest Management Technology in Basmati to
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Executive Summary

1. *Due to efforts under NRTT project, the area under basmati has increased significantly in the cropping pattern which has positive impact on various economic and environmental factors.*
2. *The average yield of Pusa 1121 increased by about 11% and in case of Basmati 386 by 7.5% accounting for enhancement of gross returns by Rs7047/acre and Rs7874 /acre respectively.*
3. *Significant positive impact was realized in terms of water saving, improvement in soil health and expansion of livestock enterprises as the area under basmati has shot up replacing non-basmati varieties.*
4. *Price plays an important role in improving the crop economics and the quality improvement ensured a premium price of Rs100/qt*
5. *Number of sprays has declined by about 50% and similarly use of fertilizer was restricted to recommended level, resulting in cost reduction by about Rs1055/acre*
6. *Seed of green manuring crops if made available just after the harvest of rabi crops can improve upon the soil health and reduce cost further*
7. *Market information cell with predictions about basmati price based on relevant parameters or sale through contract farming can help in improving the livelihood further.*
8. *There is a need to make the linkage with state department of agriculture more effective.*
9. *Continuation of the project in still uncovered villages is strongly felt due to wide technology adoption gap in basmati crop.*

1. Introduction:

Crop diversification is one of the most serious concerns confronting Punjab agriculture which has received attention not only of state government and the scientific world but also realized from food security angle of the country. Rice is a typical crop which entered the state crop pattern during green revolution era and come to stay as the most important kharif crop. Recently, its stagnating productivity and rice crop as a cause ecological degradation are worrisome. The excessive use of fertilizers and pesticides, air pollution, decelerating ground water and deteriorating quality of food products are some of the glaring associated ecological problems. Thus for diversifying area from rice to alternative crops in the cropping pattern, there is need for seeking the economically potential alternatives. Basmati within rice is important to address the problem in view of the fact that it would

- minimize the use of natural resources, particularly water since the water requirements of paddy are much 25-30 per cent higher than basmati rice
- lesser use of electric power and diesel owing to saved water use
- generate exportable potential to evade the problem of storage and post harvest wastage
- minimize air pollution because straw is economically used for livestock
- improve the soil health by recycling straw
- improve farm income by three crop rotations and
- break the stagnation impasse of rice

Against 5.2 lakh hectares last year, the area under Pusa 1121 jumped to 6.22 lakh while that under traditional varieties fell from 87,000 hectares last year to 57,000 in the

country. Export of basmati has also been increasing steeply during the past decade. It was about 0.7 million tones worth about Rs 2 million in 2002-03 which subsequently increased to 3.2 million tones valued at Rs15.5 million in 2011-12 (Appendix 1). Taking stock of situation, sincere efforts of Navajbai Ratan Tata Trust (NRTT) by setting up Reviving Green Revolution (RGR) cell and roping in of State department of agriculture, the area under Basmati has been steadily increasing in Punjab, which touched a level of 2.66 lakh hectares during the year 2011, thus accounting for about 9% area under rice crop. Somehow, due to lack of awareness, still Basmati farmers are using more than the recommended levels of water, fertilizers and pesticides. Integrated Pest Management (IPM) for proper management of pests and fertilizers is essentially required. Navajbai Ratan Tata Trust in collaboration with State Department of Agriculture, Punjab initiated a project entitled “*Promotion of Integrated Pest Management Technology in Basmati to boost Diversification in Punjab*”. This project made an effort for promoting area under Basmati by providing technical knowledge to the farmers for bridging the technical gaps and to exploit its potential so that farmers can get remunerative return from Basmati crop.

The main aims of this project are to Increase area under basmati by replacing non-basmati paddy to minimize water use, reduce the use of agro-chemicals and thus cost of cultivation, improve crop yield & quality of the basmati grain and provide related information to the farmers regarding basmati cultivation. With assured irrigation, Punjab has brought 28 lakh hectares under the paddy crop in 2012. The area is shifting towards late-sown and water-economical basmati, accounting for nearly one-fourth out of 28 lakh hectares of the state's paddy area. Further, this shift is mainly in favour of Pusa 1121

variety, which has been fetching high prices for the last few years owing to a growing international demand.

Activities undertaken under the project included capacity building of farmers through training to the village scouts and field officers, establishment of IPM information centers in selected villages, soil and water testing, selection of varieties, seed and nursery treatment, maintaining plant population, lopping of basmati 386 crop, survey the basmati fields regarding identification of insect/pests and disease attack and suggest the control measures according to economic threshold level.

2. Objectives:

This impact assessment survey report is an effort to achieve the following objectives:

- a) To assess the consolidated impact on basmati crop in terms of level of adoption of technology in terms of yield gain, quality improvement, cost reduction and ecological improvements
- b) To examine the need for continuation of efforts and interventions for increasing area under basmati crop and livelihood of farm families.
- c) To assess the sequential and cumulative impact over three last three years highlighting need assessment for continuation of interventions in future.

3. Methodology

The NRTT project ‘Promotion of Integrated Pest Management Technology in Basmati to boost Diversification in Punjab’ is in progress in three districts of Punjab viz. Gurdaspur, Amritsar and Tarn Taran. In each district 50 villages and thus 150 villages in three districts have been covered. The survey to assess the impact of the project was

carried out in these districts by taking data from 313 basmati farmers selected from 41 villages covered under the project in these districts (Appendix 2). The information was collected regarding level of education, farm size, irrigated area, source of irrigation, source of power, livestock kept, area, yield and price of rice varieties raised, crop rotations and the production practices followed for growing basmati during 2012, facilities provided under NRTT project, realized impact and other perceptions about continuation of the project. A comparative picture from 157 farmers taken from 18 non-project villages in the area was also obtained to act as baseline information to study the impact of the project. Data pertaining to the crop year 2012-13 and was collected through personal interview method. Analysis of the data so collected was analyzed using various statistical tools discussed in the respective sections. Following salient results was brought out.

The data of the past impact assessment reports prepared on similar aspects were also compiled and presented to bring out the cumulative effect of such interventions and suggest if there is any need for continuation the project in future.

4. Results & discussion

4.1: Level of education

As an important social parameter of the study area, level of education was studied and it was found that the respondents varied widely with respect to the formal education attained by them. Quite a few of them were illiterate and a majority was matriculates and a small number were graduates as well. The average years of schooling worked out to 6.7, 11.9 and 10.1 in Amritsar, Gurdaspur and Tarn Taran districts respectively with overall average of 9.2. A similar picture of non-project farmers showed an average year

of schooling as 10.9. However, correlation between level of education and average yield was -0.17 and did not turn out to be statistically significant.

4.2: Farm size

As presented in Table 4.1, the average farm size owned by the respondents was 10.58 acres and another 1.18 acres was leased in from others. This made an overall average operational farm size as 11.76 acres meaning thereby that 90% of the operational area was owned and 10% was taken on lease. The average operational area was higher in Tarn Taran district as compared to Gurdaspur and Amritsar. The terms of lease was settled as cash payment and average land rent was estimated as Rs30100 per acre with variation from 28000 to 32000/acre/ year.

In terms of distribution of respondents according to farm size, it could be seen from Table 4.2 that about 47% were having 5-10 acre farm size, 14.4% had 2.5 to 5 acre and 1.6% had as low as less than 2.5 acres of land holdings. Only 8.9% respondents were having more than 20 acre size of farm holding. Thus a vast majority of respondents was having small size of farm area in spite of the fact that family as a unit was taken and more number of non-farming interests are involved in sharing the output.

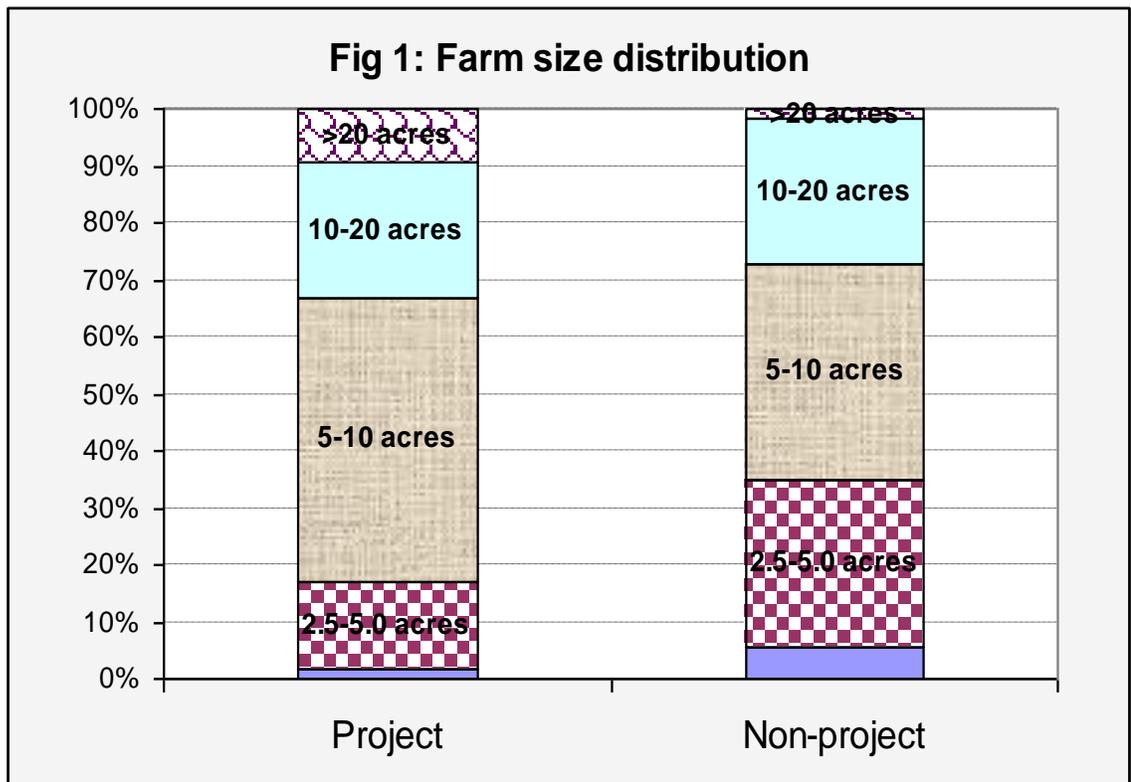
Comparative statistics of non-project farmers showed relatively more number of smaller farmers with average farm size of 9.02 acres of which about 7% area was added through leasing in from others.

Table 4.1: Average farm size of the respondents (acres)

<i>District</i>	<i>Owned</i>	<i>Leased in</i>	<i>Operational</i>	<i>Average land rent</i> <i>(Rs/acre)</i>
<i>Amritsar</i>	9.12	0.85	9.96	30980
<i>Gurdaspur</i>	10.67	0.00	10.67	28890
<i>Tarn Taran</i>	12.48	2.69	15.17	29530
<i>Overall project</i>	10.58	1.18	11.76	30100
	(90.0)	(10.0)	(100.0)	
Non-project	8.43	0.62	9.02	29150
	(93.1)	(6.9)	(100.0)	

Table 4.2: Percent of respondents in different farm size categories

District	<2.5 acres	2.5-5.0 acres	5-10 acres	10-20 acres	>20 acres
Amritsar	2.3	12.3	58.5	20.0	4.6
Gurdaspur	2.3	26.4	40.2	14.9	11.5
Tarn Taran	0.0	6.3	38.5	32.3	12.5
Overall project	1.6	14.4	47.3	22.4	8.9
Non-project	5.7	29.3	37.6	25.5	1.9



4.3 Source of power

As may be viewed from Table 4.3, almost three-fourth number of respondents had owned tractors. The number was as low as 67% in Gurdaspur and as high as 98% in Tarn Taran district. About 62% of non-project farmers also had their own tractors for this purpose. The ownership of tractor had direct relationship with the farm size. The rest farmers were hiring in tractor to carry out major farm operations. Small farmers are now less averse to custom hiring tractor and other farm machinery to economize the cost of operations and it is gaining popularity with the motive of avoiding undue heavy investment. Normally the cost of land preparation by two ploughings and one puddling was stated to cost about Rs2000 per acre. Bullock as a source of draft power had almost gone missing in the region.

Table 4.3: Source of power (Per cent farmers)

<i>District</i>	<i>Tractor</i>	<i>Bullock</i>	<i>Custom hiring</i>
<i>Amritsar</i>	71.5	0.8	29.2
<i>Gurdaspur</i>	66.7	0.0	33.3
<i>Tarn Taran</i>	97.9	0.0	2.1
<i>Overall project</i>	78.3	0.3	22.0
Non-project	61.8	0.0	38.2

4.4 Irrigation source

Invariably all farmers were having electric tubewell as a source of irrigation (Table 4.4). Diesel engine was also kept by large number of them to cope up with the situation in case of shortage of electricity supply. Only 2.2% project farmers and 0.6% of non-project farmers reported of having canal as an additional source of water. It was interesting to note that in some cases the small farmers were sharing a common tubewell to economize the cost of production.

Table 4.4; Source of irrigation (Per cent farmers)

District	Tubewell	Canal
Amritsar	100.0	3.1
Gurdaspur	100.0	2.3
Tarn Taran	100.0	1.0
Overall project	100.0	2.2
Non-project	100.0	0.6

The foregoing parameters are discussed for the reason that it provides background of the sample farms. By comparing both set of samples (project and non-project) reliability of data is estimated and further some parameters have impact on the socio-economic aspect as well. Small size of holding, poor education level of the respondents shows that relatively poor and less educated farmers get covered and reap the benefit of the project. Earlier common allegation was that Punjab farmers operate in irrational economic zone and incur unnecessary investment on farm machinery. The situation appears to have reversed that now a large number of small farmers are switching over to custom hiring and sharing out of machinery.

4.5 Dairy animals

The information about the number of cows and buffaloes kept was gathered with the intention of understanding the relationship of livestock with basmati crop which was hypothesized as highly positive. Except for a few, vast majority of respondents were having dairy animals i.e. cows and buffaloes. As shown in Table 4.5, the average number of cows and buffaloes came out to 2.25 and 2.17 respectively in case of project farmers and 1.31 and 1.45 in case of non-project farmers. This has far reaching implications on sustainability and environmental parameters. The basmati straw is fed to the livestock and thus through FYM, it is recycled in the soil which not only improves the soil health, minimizes the fertilizer use, lessens air pollution but also lowers the cost of milk production. More detailed picture is given under section 4.13 under basmati straw.

Table 4.5; Average number of milch animals per farm

District	cows	Buffaloes
Amritsar	3.39	2.40
Gurdaspur	1.21	0.70
Tarn Taran	1.66	3.18
Overall project	2.25	2.17
Non-project	1.31	1.45

4.6 Area & Varietals' Position of rice crop

This area represents the traditional rice belt of Punjab state where basmati varieties were dominantly sown during the kharif season over a long period of time. In the sample of respondents, about 90% area is put under rice and the rest 10% covered under fodder and other minor crops. In Gurdaspur district the area under rice was relatively lesser (80.5%). On the whole, basmati accounted for 54.6% and non-basmati covered almost 35% of the cultivated area. In contrast to other districts, the respondents of Amritsar district revealed that about 74% area was put under basmati.

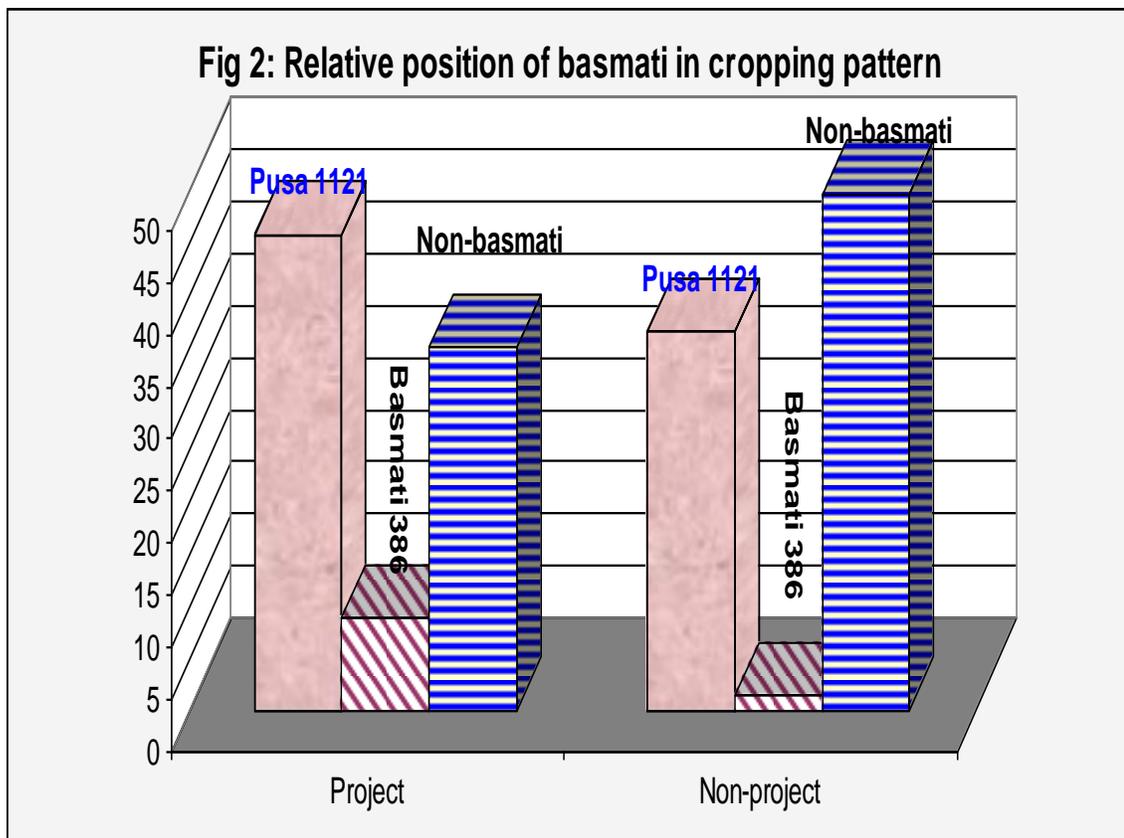
A further split up of area under basmati indicated that Pusa 1121 was the most dominant variety covering about 46% of cultivated area. Basmati 386 on the other hand occupied less than 9% area that too mainly in Amritsar district. The higher yield of Pusa 1121 realized as against Basmati 386 variety, which does not get compensated by slight higher price of Basmati 386 and thus economic edge of Pusa 1121 was the sole reason due to which Basmati 386 is bowing out. More details about the comparative economics of different basmati and non-basmati varieties is presented in the following section.

Amongst the non-basmati varieties HKR47 covered about 24% of cultivated area on the project farms. The other varieties such as HKR127, PR118, PR113, PR111, *Sarbati*, *Govinda*, *Pusa 44* together accounted for only 11% area. Typically, Tarn Taran respondents revealed as high as 37% and those of Gurdaspur had little over 24% area under such varieties. In case of non-project farmers, non-basmati varieties dominated their cropping pattern even though the total area under rice was comparable with that of project farmers. For varieties adoption, perhaps the most convincing forces are the neighbouring farmers and their consistent past experience with such varieties on the basis of soil, water, market and other parameters.

However, it is worth mentioning here that due to effort under NRTT project, area under basmati has increased significantly which impacts positively the various other factors such as profitability, water saving, improving soil health, lessening the air pollution etc.

Table 4.6; Position of Rice in the cropping pattern, *kharif* season (% area)

District	Basmati varieties			Non-basmati varieties			Total rice
	Pusa 1121	Basmati 386	Total basmati	HKR47	Others	Total Non- basmati	
Amritsar	51.40	22.51	73.91	18.84	0.46	19.31	93.22
Gurdaspur	45.41	0.11	45.51	10.77	24.24	35.01	80.52
Tarn Taran	41.01	2.32	43.33	36.77	12.09	48.86	92.18
Overall project	45.77	8.87	54.63	23.90	11.06	34.96	89.59
Non- project	36.44	1.48	37.92	37.29	12.50	49.79	87.71



4.7 Yield and price of basmati rice

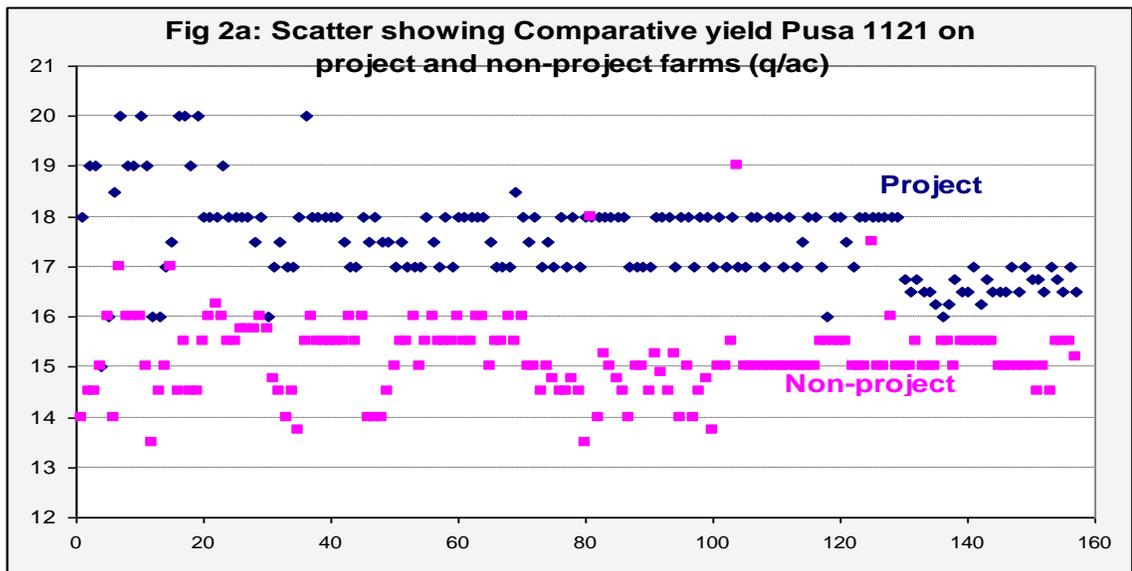
The average yield in case of project farmers was estimated as 17.37 q/acre for Pusa 1121 and 11.49 q/acre in case of Basmati 386 with little variations across the districts except that yield of Basmati 386 in Gurdaspur district was low but due to meager number of observation for the variety, it could not be authenticated. Conversely, average yield on non-project farms worked out to 15.19 and 9.56 qt/acre respectively. This showed a productivity gap between these two categories of farmers as 2.18 and 1.93 qt/acre which could undoubtedly be termed as an impact of the project. The yield gap between project and non-project farmers was put to t-test which gave the t value which came out as 9.499 was statistically highly significant at 0.01 level.

During the crop market season 2012-13, the price of Pusa 1121 variety was low initially at Rs2400/qt but subsequently increased to Rs3900/qt. Most of the farmers who sold the produce immediately after harvest realized lower price as compared to the farmers who stored for about two months. Like yield gap, a similar economic impact of the project was clearly observable from the price difference between project and non-project farmers which came out to Rs100 and 157 per quintal for Pusa 1121 and Basmati 386 varieties respectively. The price difference was reported due to spray of tilt under the project, which not only controls certain diseases but also brings luster in the grains and helps in fetching better price.

Table 4.7: Average area, Yield and price of basmati rice on sample farms

District	Pusa 1121			Basmati 386		
	Area (acre)	Average yield (q/acre)	Price (Rs/qt)	Area (acre)	Average yield (q/acre)	Price (Rs/qt)
Amritsar	5.03	17.74	2573	2.24	11.48	3315
Gurdaspur	4.84	16.62	2644	0.01	9.00	3270
Tarn Taran	6.22	17.57	2388	0.35	11.71	3222
Overall project	5.34	17.37	2536	1.04	11.49	3302
Non-project	3.29	15.19	2436	0.13	9.56	3145
Edge of project farmers	+2.05	+2.18	+100	+0.91	+1.93	+157

The gap in yield and price together accounted for enhancement of gross returns by Rs7047/acre in case of Pusa 1121 and Rs7874 /acre in case of Basmati 386. As a consequence of increase in area under these varieties by 2.05 acre and 0.91 acre on an average, the gross farm income was estimated to increase by Rs14447 and Rs7165 respectively.



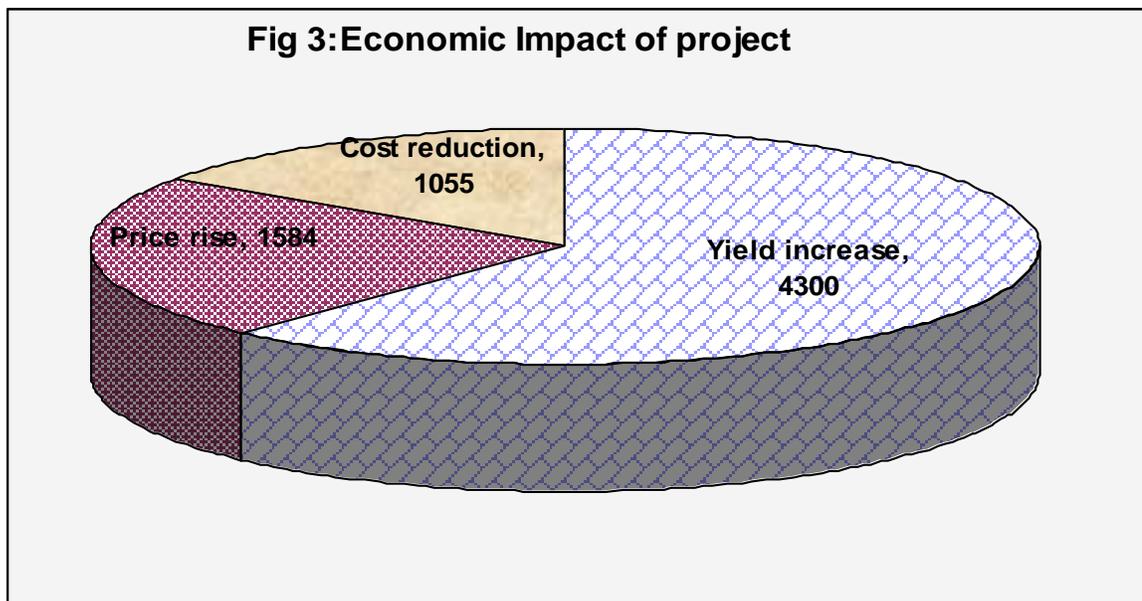
4.8 Economic impact of the project reaffirmed

As a cross question to verify if there is really an economic impact on the livelihood of farmers, the respondents were asked about how much they expect to have gained by the project efforts. The following results certified that impact discussed above was in the same direction and of similar quantum as discussed in the foregoing section. As a result of various interventions described above, the farmers reported improvement in yield, increase in price and reduction in cost. Though the response varied from farmer to farmer, the average increase in yield was reported as 1.72 qt/acre which could mean the income enhancement by Rs4300/acre. Interestingly, the grains became more lustrous with

the use of tilt. The average price increase was Rs88/qt multiplied with average yield of 18 qt/acre means increase in income by Rs1584/acre. Direct impact on cost was realized through reduction in the use of fertilizers and pesticides which averaged to Rs1055/acre. The number of sprays also declined by about 1.5 or about 50% of what it was earlier apart from stoppage of indiscriminate use of Padan. Thus the net measurable economic impact was estimated as Rs6940/acre. Therefore, the results almost synchronize with each other.

Table 4.8: Economic impact of project

District	Yield increase	Price rise	Cost reduction	Less number of sprays
Amritsar	1.73	92	1113	1.4
Gurdaspur	1.29	93	1200	2.3
Tarn Taran	1.80	70	776	1.2
Overall project	1.72	88	1055	1.5
Economic impact	4300	1584	1055	



The above sections lead us to conclude that by way of various interventions:

- a) area under basmati has shot up replacing non-basmati varieties
- b) the average yield increased by about 11% in case of Pusa 1121 and by 7.5% in case of Basmati 386
- c) Price due to quality improvement showed an increase of Rs100/qt
- d) Cost decline by about Rs1055/acre
- e) Number of sprays has declined by about 50% and similarly use of fertilizer was restricted without adversely affecting the yield.

4.9 Yield and price of non-basmati rice

A similar analysis of non-basmati variation between project and non-project farmers was made (Table 4.9). As discussed earlier, HKR47 variety was the most dominant covering 24 and 37 per cent area on project and non-project farms respectively. The average yield was estimated as 27.92 qt/acre on project and 26.74 qt/acre on non-project farms. A similar situation was noticed for other varieties as well. However, no significant difference in average realized price was observed because these varieties were sold at MSP to the procurement agencies.

Although it is not possible to exactly quantify the impact of NRTT project that percolated to the non-basmati and even other crops but based on this analysis, the project is giving the positive flavour for other enterprises as well.

Table 4.9: Average area, Yield and price of non-basmati rice on sample farms

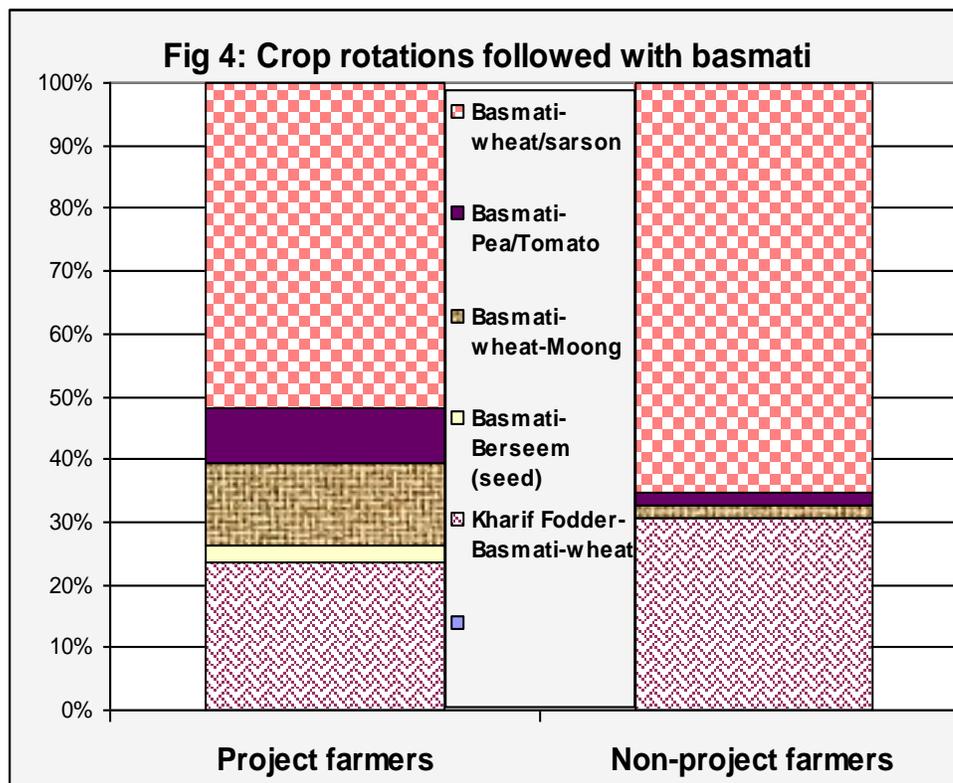
District	HKR47			Others		
	Area (acre)	Average yield (q/acre)	Price (Rs/qt)	Area (acre)	Average yield (q/acre)	Price (Rs/qt)
Amritsar	1.88	28.78	1260	0.05	27.33	1233
Gurdaspur	1.15	29.04	1273	2.59	27.44	1266
Tarn Taran	5.58	26.96	1278	1.83	27.47	1297
Overall project	2.81	27.92	1271	1.30	27.44	1275
Non-project	3.36	26.74	1278	1.13	26.94	1284

4.10 Crop rotations with basmati crop

Table 4.10 presents the crop rotations followed by the basmati farmers to capture another short duration crop in major crop rotation. The addition of summer moong, kharif fodders, berseem and some vegetable crops also helped to improve the farm income. A number of farmers wanted to go in for green manuring if the seed of dhaincha is made available at proper time. About 7% reported that they were green manuring the pulse crop before transplanting.

Table 4.10: Major Crop rotations followed by respondents (%)

S. No.	Crop rotations	Project farmers	Non-project farmers
1	Kharif Fodder-Basmati-wheat	23.5	30.8
2.	Basmati-Berseem (seed)	2.9	0.0
3.	Basmati-wheat-Moong	13.1	1.9
4.	Basmati-Pea/Tomato	8.6	1.9
5.	Basmati-wheat/sarson	51.9	65.4
Total		100.0	100.0



4.11 Agronomic practices

4.11.1 Nursery raising: For raising nursery of an acre, the area under nursery kept by the farmers was reported as two to three marlas. In each marla of land, 2-3 kg of seed was used. Thus the total seed used varied between 5 and 7 kg per acre. Before sowing the seed was treated with fungicides as a component of NRTT intervention. Against the recommended area of about 6 marlas for one acre nursery, it was a deviation and thick nursery was justified by them for keeping the weeds under control, better care and uprooting it is easy. Less seed rate was also justified by the fact that labour keep less plant population and put only one seedling at a place because of contractual labour is employed. About half to one kg of urea was applied to one marla of nursery and irrigation every third day meaning thereby about 10 irrigations were applied. Use of 250-500 g of zinc sulphate to nursery was also made by a sizable number of farmers in order to check the later on deficiency of it in the crop. Nursery was transplanted while it attained the age of 30-32 days.

4.11.2 Post-nursery operations: Two to three ploughings followed by one or two puddlings were given for preparing the land before transplanting. The cost of transplanting nursery was done manually costing Rs2000/acre. No case of direct sowing was reported. Before transplanting, basmati nursery was treated with fungicides. Therefore, no disease was reported by the farmers. About 7% farmers used green manuring before transplanting. FYM was used by 55.9% of respondents. Other nutrients applied averaged to 38.6kg urea, 1.3 kg of super phosphate, 5.1 kg of Muriate of potash

and 10.8 kg/acre of zinc sulphate. Only leaf folder and hoppers were required to be controlled with the help of 1-2 sprays with an average number of 1.63, 0.79 and 1.53 in Amritsar, Gurdaspur and Tarn Taran districts respectively. In case of non-project farmers about 60% used Padan pesticide as a preventive measure to control pests. No lopping of basmati was done by any farmer.

The number of irrigations applied to the crop by default gets reduced due to late transplanting, synchronizing period of rains and mild climate which result in significant saving of water. About 14.1% farmers got harvested basmati with combines while all others used manual labour to harvest. The cost of operation was Rs1000 and Rs2500 per acre respectively but the quality of grain and saving of basmati straw was higher in done manually.

4.12 Economics of crop

Variety- wise economics of basmati and non-basmati realized by farmers on an average is presented in Table 4.13. After deducting operational costs, Pusa 1121 promised the highest return with Rs33400 /acre closely followed by Basmati 386. The major players in crop profitability are yield and price factors. The major non-basmati variety showed return of Rs23040/acre.

In the past reports, I have been requesting to study HRK 47 variety has been widely adopted in the area and suggested that it needs to be studied in detail for including in POP. However, a mention of it amongst other popular varieties has been made in the PAU, POP Kharif of 2013. Amongst non-basmati varieties, the farmers have high preference for it in terms of profitability plus least price risk involved unlike basmati.

Table 4.12: Variety- wise economics of basmati vs non-basmati varieties

Item	Pusa1121	Basmati 386	HKR 47
Land preparation	2000	2000	2000
Nursery & transplantation	2500	2500	2500
Fertilizers	1200	600	1400
Plant protection	300	200	500
Irrigations	1800	1500	2400
Harvesting & threshing	2000	2500	1000
Marketing	1500	1200	3000
Total cost	11300	10500	12800
Yield*price	18*2400	12*3300	28*1280
Gross Return	43200+1500*	39600+2000*	35840
Return over operational cost	33400	31100	23040

*value of straw

4.13 Impact on basmati straw

The average yield of basmati straw was estimated as 28 qt/acre as green or 18-20 qt/acre as dry straw. The average price of green straw was Rs2000/acre in case of Basmati 386 and Rs1200-1500/ acre in case of PUSA 1121 variety. The quantity of straw harvested was more in case of manual harvesting as compared the mechanized harvesting. It was used as livestock feed and was considered enough for the livestock of the area for about 3-4 months. Notably the wheat straw during November-March is selling at a high price; basmati straw is available in adequate quantity during this period.

This helps in tiding over the scarcity period and thus lowers the cost of milk production. Still more relevant to mention over here is that unlike non-basmati rice, basmati straw gets recycled in the form of FYM into the soil rather than being burned and creating air pollution in the area. Another important feature of basmati straw in this region is that it attracts a large number of migrant *Gujjars* from Jammu and Kashmir and Himachal Pradesh with large animal herds, creating more demand for basmati and even non-basmati straw was used for thatching of their living huts and animal sheds. Some farmers even provided them facilities and encouraged them to stay on their farms as large number of animals enriched the soil by waste droppings.

4.14 Specific problems in basmati cultivation

To understand if some more interventions are sought by the farmers or typical problems faced by them in terms of crop logging, pest attack, non-availability of quality seed, water logging etc but the response was invariably negative, stating that during the past season they did not face such problems. Only marketing problem in the form of violent price fluctuations was reported by most of the farmers. During the crop market season 2012-13, the price of Pusa 1121 variety was low initially at Rs2400/qt but subsequently increased to Rs3900/qt. The farmers who sold the produce immediately after harvest realized lower price as compared to the farmers who stored for about two months. Thus the trade and export policies in this regard have strong impact on the crop economics and thus planning area for the oncoming basmati crop. It is thus useful if market information system and intervention in this area are strengthened for guidance to the farmers.

4.15 Facilities availed under the project

While enquiring from farmers, it was ascertained that seed treatment followed by nursery treatment about a month later was done to keep the crop free from the attack of various probable diseases in the area. Information provided for control of various pests and nutritional deficiencies was well in time. The information centre established in the village was regularly visited by the farmers and reported that the displayed information very useful. The farmers were in constant touch with the village scouts and attending the meetings regularly and thus found spot guidance by the experts, particularly with live samples very helpful. It was reported by 34% respondents that not only farmers of adopted villages but also from neighbouring villages also participated in the project. No specific suggestion came out from farmers or village scouts about structural change in terms technology dissemination system.

4.16 Priority areas of spending

Various alternative and priority areas of spending were specified as repayment of debts by 36% respondents, investment in terms of purchase of livestock and construction of sheds (77%), purchase and repair of farm machinery (28%), purchase and improvement in land and water resource (17%). Similarly, consumption expenditure in terms of social ceremonies was one of the priorities for 47%, education of children for 87%, house building for 51% and expenditure on food was expressed by 65% respondents to meet growing domestic expenditure. Topmost priority area was thus education of children followed by purchase of livestock, particularly cows and buffaloes and food expenditure.

Table 4.16: Spending priorities of the respondents

<i>Priority item of spending</i>	<i>% affirmative response</i>
<i>A. Repayment of debts</i>	36.2
<i>B. Investment in</i>	
<i>Livestock</i>	76.9
<i>Machinery</i>	28.5
<i>Land</i>	16.9
<i>C. Household expenditure on</i>	
<i>Social Ceremonies</i>	46.9
<i>Education of children</i>	86.9
<i>House building</i>	50.8
<i>Food</i>	65.4
<i>Others</i>	4.6

4.17 Environmental impact

4.17.1 Agro-chemicals

Notably the number of sprays against various pests such as hoppers, leaf folder, stem borer thrips etc was reported as 3.1 which declined to 1.6 showing significant reduction in pesticide load (nearly half). However, the sprays against diseases remained at two. The use of fertilizers too declined. In most of the non-IPM villages, use of fertilizers to basmati crop was high and comparable with non-basmati. Thus in spite of mass media and other available information systems, farmers do not accede to change. Therefore, the impact of the IPM system under the project has its relevance in terms of on-the-spot guidance and demonstrating in the field.

The extent of solved pest problem to be attributed to the project was reported in terms of score out of 10. The average score was 7.9 (Table 4.16) which means that about 79% of the pest problem has been got addressed.

4.17.2 Natural resources

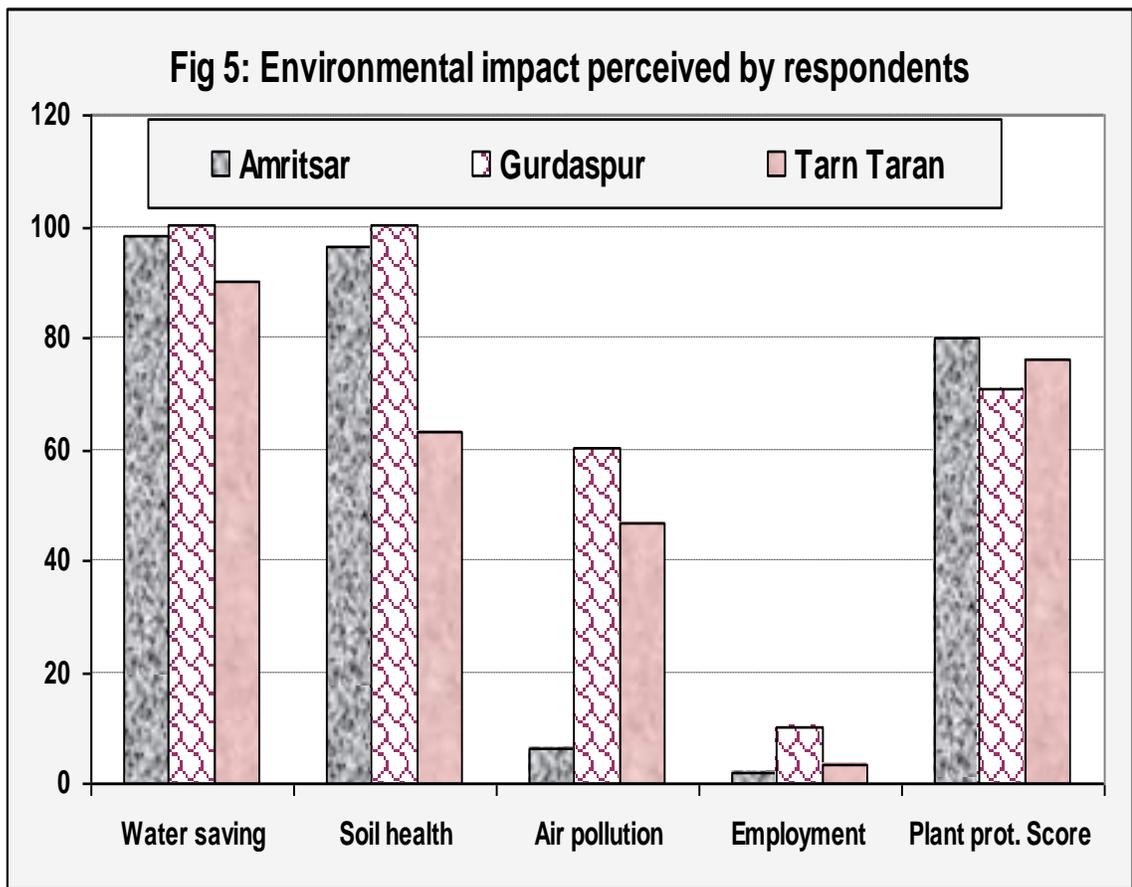
Water saving was stated by about 97% respondents with an average saving of 15-20% less irrigations. As evidenced by 90% respondents, soil health improved due to recycling of crop residue, balanced use of fertilizers and use of green manuring. Minimizing air pollution was an obvious positive impact of the project as no burning could be viewed in the area. This fact was further confirmed by 18% respondents.

4.17.3 Employment of labour

Very few respondents were of the opinion that labour employment due to the project increased except that some realized positive impact due to higher output resulting in more employment of labour.

Table 4.17: Per cent response about positive environmental impact

District	Water saving	Soil health	Air pollution	Employment	Score of plant protection (base 10)
Amritsar	98.3	96.6	6.3	1.8	8.0
Gurdaspur	100.0	100.0	60.0	10.0	7.1
Tarn Taran	90.0	63.3	46.7	3.3	7.6
Overall	96.8	90.4	17.8	2.6	7.9



5. Marketing aspect

On the basis of geographical appellations under WTO regime, only India and Pakistan are the two countries which can produce basmati rice. But both countries have never negotiated with each other for market sharing and are thus getting competitive lowest prices. However, under similar names such as Texamati, Siamati etc USA, Thailand, Philippines are some other countries which have also started cultivation of long slender grain rice. Consumers' preference for basmati is increasing due to increasing income level and consumerism. As shown in appendix 1, price of basmati in the world market has fallen from about Rs6100/qt in 2008-09 to 4800/qt in 2011-12 but during the year 2012-13, it has again gone up due to interplay of supply and demand forces

including previous years' stocks, planning area under basmati, crop conditions, tariff and other export-import policy issues of importing and exporting countries. In spite of spurt in global price, the farmers were again deprived of gain which percolated to them when almost 80% of produce was already sold out.

Broadly two groups of markets viz. west Asia requiring long slender grains without caring for fragrance and converse group Europe, America, Australia etc caring more for organic, certified quality and fragrance. Similarly, within the country we have four major pockets growing basmati about which production plan can be had well in time. A lot of online literature is also available which if compiled with primary field level information can help in fairly reliable market projections.

Such detailed picture beforehand necessitates setting up of market intelligence cell rather than to put forth the demand for MSP by the government. This would help farmers to take crucial decisions about when, where and how to sell and even planning for area under the crop to cater to the highly volatile global market.

6. Impact assessment summarized

Based on the results and discussion presented above, a brief outcome is shown in the Table 6. A large number of parameters such as cropping pattern, cropping intensity, yield and price improvements, decline in cost of cultivation, particularly, the use of agro-chemicals, minimizing ecological degradation in terms rationalizing the use of natural resources etc can easily be pinpointed.

Table 6: A summary of Impact

S. No.	Parameter	Impact
1	Cropping pattern	With a motive of crop diversification, the area under basmati increased as it is clear from the data which shows basmati covered 54.6% and 37.9% area on project vs. non-project farms and non-basmati was grown on 35.0% and 49.8%.
2.	Crop Yield	Increased by about 11% and 7.5% in case of Pusa1121 and Basmati 386 respectively. On the whole 1.72qt/acre amounted to Rs4300/acre.
3.	Price increase	Increase by about Rs100/qt due to grain luster.
4.	Use of agro-chemicals	Decline in use of fertilizers and pesticides, particularly indiscriminate use of Padan was conspicuously checked. The pesticide load was exactly halved.
5.	Cost of production	Declined by Rs 1055/acre due to balanced use of inputs
6.	Water saving	Saved water varying from 20-30%
7.	Soil health	Recycling of paddy straw was evident
8.	Other enterprises	Higher availability of straw and decline in pesticide load encouraged dairy farming
9.	Air pollution	Checked to a great extent by not burning paddy straw
10	Cropping intensity	Increased due to introduction of third crop in rotation.

7. Summary

The study on impact assessment study of the NRTT sponsored project on *Promotion of Integrated Pest Management Technology in Basmati to boost Diversification in Punjab* was initiated with a view to analyze the various economic, social and environmental parameters, having been impacted. Adequate samples of project and non-project farmers were selected and the respondents were enquired about the visualized impact on them during the crop season. The study brought out that due to

effort under NRTT project, area under basmati has increased significantly in the cropping pattern which has positive impact on various economic and environmental factors. The average yield of Pusa 1121 increased by about 11% in case and in case of Basmati 386 by 7.5% accounted for enhancement of gross returns by Rs7047/acre and Rs7874 /acre respectively. Significant positive impacts were realized in terms of water saving, improvement in soil health and expansion of livestock enterprises as the area under basmati has shot up replacing non-basmati varieties. Price plays an important role in improving the crop economics and the quality improvement ensured a premium price of Rs100/qt. The number of sprays has declined by about 50% and similarly the use of fertilizer was restricted, resulting in direct cost reduction by about Rs1055/acre.

It was suggested that to improve the impact further, seed of green manuring crops if made available just after the harvest of *rabi* crops can improve upon the soil health and reduce cost further. Market information cell with predictions about basmati price based on relevant parameters or sale through contract farming can help in improving the livelihood further. There is a need to make linkage with state department of agriculture still more effective.

8. Overtime Impact assessment results compiled

A similar exercise was carried out to assess the impact of the project in separate set of villages in these districts (Table 6). The results show the impact assessed at current prices and thus monetary figures need comparison with caution. For example in quantitative terms, the results are comparable but higher price of basmati has significant impact on monetary gains to the farmers which was estimated as Rs 3982, Rs 6451, Rs 4038, Rs 3296 and Rs 6939 during the years of 2007-08, 2009-10, 2010-11, 2011-12 and

2012-13 respectively. Thus significant cumulative impact of the project providing and sustaining the livelihood of farmers and farm labour are obvious. Further, a vivid comparison of project farmers with non-project farmers is a strong indication of existing wide gap in technology adoption. This makes a strong case for continuation of project in still uncovered areas of the region.

Table 8: Overtime economic assessment compiled

		Yield	Price	Cost	Total
		(qt/ac)	(Rs/qt)	(Rs/ac)	
2007-08	Quantity	1.36	31	226	
		(3400)	(356)	(226)	(3982)
2009-10	Quantity	1.84	9	244	
		(6060)	(145)	(245)	(6451)
2010-11	Quantity	1.13	24	860	
		(2818)	(360)	(860)	(4038)
2011-12	Quantity	1.00	18.8	1291	
		(1745)	(260)	(1291)	(3296)
2012-13	Quantity	1.72	88	1055	
		(4300)	(1584)	(1055)	(6939)

Figures in parentheses are in terms of value in Rupees

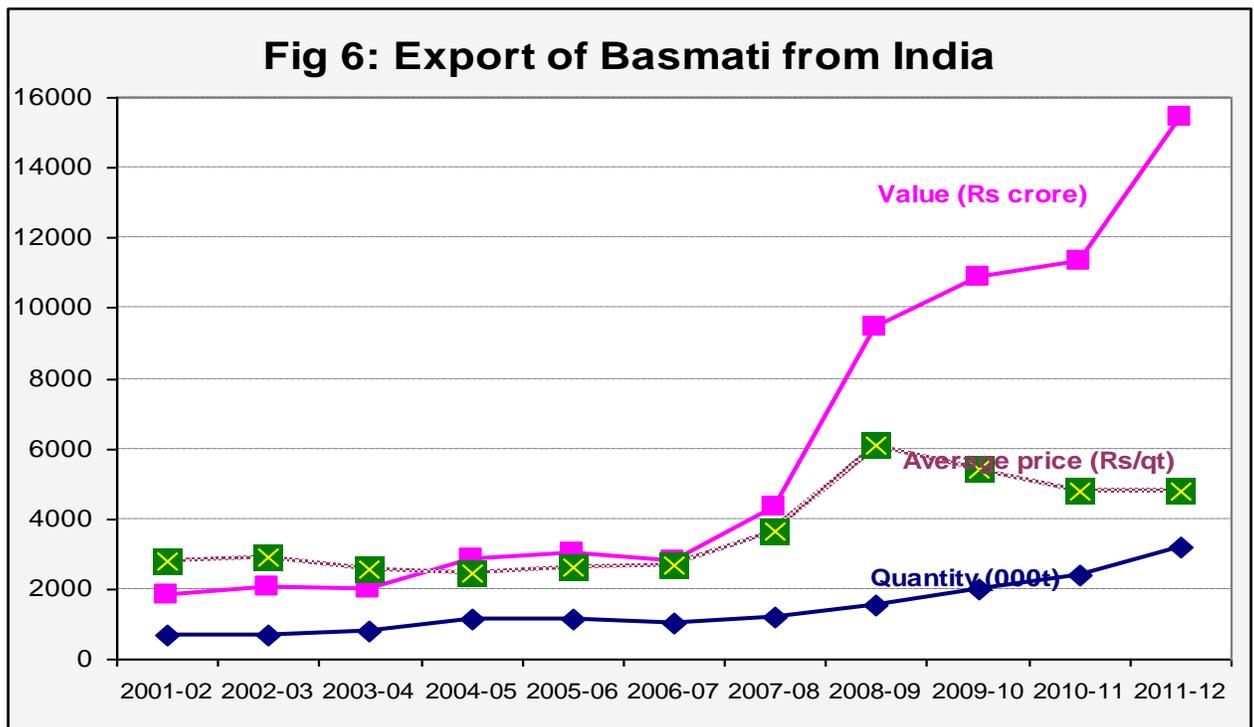
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Appendix 1: Export of basmati from India

Year	Quantity (000t)	Value (Rs crores)	Average price (Rs/qt)
2001-02	667	1843	2763
2002-03	708.79	2058.47	2904
2003-04	771.49	1993.05	2583
2004-05	1163.00	2823.90	2428
2005-06	1166.57	3043.10	2609
2006-07	1045.73	2792.81	2671
2007-08	1183.36	4344.58	3671
2008-09	1556.41	9477.03	6089
2009-10	2016.87	10889.60	5399
2010-11	2370.68	11354.77	4790
2011-12	3211.80	15450.45	4811

Source: Economic Survey of India, 2013



Appendix 2: List of blocks and villages selected for the study

S.No.	District	Block	Village	No. of farmers
1	Amritsar	Majitha	Sohian Kalan	7
2			Viram	8
3			Athwal	9
4			Sarhala	5
5			Fattubhilla	5
6			Bhoafatehgarh	5
7			Tarpai	5
8			Ramanachak	5
9			Maan	5
10			Rajatol	8
11		Attari	Bharobhall	7
12			Bhaini Raputan	6
13			Nathupura	7
14			Malluwal	5
15		Chogawan	Rabhbohali	5
16			Behrwal	5
17			Vehra	5
18			Vaniake	5
19			Tapiola	6
20			Padhri	6
21			Nurpur	3
22			Thathe	5
1	Gurdaspur	Kalanaur	Bishenkot	10
2			Nandharni	10
3			Shahur Kalan	10
4			Masatkot	10
5			Barila Kalan	10
6		Gurdaspur	Kala Nangal	8
7			Hardaan	10
8			Abbal Khair	9
9		DBN	Shapur Jajan	10
1	Tarn Taran	Patti	Dubli	9
2			kot budha	10
3			Kot data	10
4			Mann	10
5			Pangota	10

6			Alipur	10
7		Tarn Taran	Chabhal Kham	10
8			Bhojian	10
9			Jamastpur	9
10			Bakipur	9

Non-project respondents

1	Gurdaspur	Dinanagar	Sultani	10
2		Gurdaspur	Khokhar	4
3			Hayatnagar	6
4			Kala Nangal	9
5		Dhariwal	Langah Jattan	15
6			Bangowani	10
7			Lehal	10
8			Johal Nangal	10
9			Bhujraaj	10
10		Kalanaur	Deol	10
11		DBN	Chaura kalan	9
12	Tarn Taran	Tarn Taran	Bakipur	1
13			Jamastpur	10
14			Bhojian	10
15			Chabhal Kham	3
16		Patti	Mann	9
17			kot budha	11
18			Dubli	10
	Total			157