

## **PROMOTING BETTER MANAGEMENT PRACTICES**

### **An Initiative of WWF – Pakistan to reduce the ecological footprint of thirsty crops**

By:

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## ABSTRACT

Sugarcane and cotton are two of the major water intensive and polluting crops, respectively, grown in Pakistan. Sugarcane consumes more water per unit area of crop than any other crop and cotton accounts for 70% of all pesticides applied in Pakistan. As part of its Global Conservation Programme, WWF aims to help make cotton and sugarcane cultivation part of a sustainable industry so as to make its production environment friendly and to reduce its impacts on priority ecosystems. WWF – Pakistan, Pakistan's largest environmental organisation, took a step and launched the "Better Management Practices for Water Thirsty Crops" project to ensure sustainable sources of freshwater to support livelihoods of poor rural communities. The project created a mechanism for increasing water availability and reduced pollution by rationalizing use of water and pesticides in cotton and sugarcane production through developing site specific BMPs (Better Management Practices). BMPs are practices which optimize the three pillars of sustainability: social responsibility, environmental integrity and economic viability by marrying together the financial requirements of agriculture, such as high yield, with environmental and social concerns, such as water and pesticide use. The BMPs validated at research centres were subsequently tested in a number of farmer fields as well to check their suitability in project areas of Bahawalpur for cotton and Faisalabad for sugarcane. For widespread dissemination of BMPs; participatory approaches based on ToT (Training of Trainers), FToF (Farmers Training of Facilitators) and FFS (Farmer Field School) activities were implemented. Under ToT activities 52 MFs (Master Facilitators) were trained. Subsequently, these MFs established 120+ FFS with more than 2200 farmers, over an area of 24,000 acres to apply these BMPs on cotton and sugarcane growing areas. The BMP cotton farmers made crop management decisions which resulted in 39% reduction in synthetic fertilizers, 38% in irrigation water and 47% in pesticides with a cost-benefit ratio of 1:3.2 for BMPs as compared with 1:2.5 of non-BMPs; likewise the BMP sugarcane farmers saved 25% reduction in synthetic fertilizers, 18% in irrigation water and almost 100% in pesticides with cost benefit ratio of 1:1.82 for BMP as compared 1:0.9 of non-BMP with around 30% increase in gross margins on average.

**KEY WORDS:** Better Cotton Initiative (BCI); Better Sugar Initiative (BSI); Better Management Practices (BMP); Integrated Pest Management (IPM); Farmer Field School (FFS); Agro Eco-System Analysis (AESAs); Pakistan

## INTRODUCTION

Water scarcity is a serious concern for Pakistan and will become one of the most pressing issues faced by the nation in coming years. Water availability and quality in Pakistan are already unable to meet the economic, social, livelihood and environmental needs of the country. According to the International Water

Management Institute (IWMI), Pakistan will require more than 100% the present amount of water by 2025 unless water use patterns are altered. Water scarcity is largely due to wasteful agricultural practices which consumes over 95% of the water abstracted from the Indus for irrigation and due to inefficient agricultural system only 35% reaches the crop. Agriculture is also a major polluter of water courses due to excessive use of pesticides and chemical fertilizers.

Agrarian economy contributes around 24% of the GDP, where major crops like wheat, sugarcane, cotton and maize account for 41% of value added. Sugarcane and cotton are the most water intensive and polluting crops, respectively, grown in Pakistan and are also part of the economic mainstay of the country, with 68% of the population reliant on agriculture for its livelihood, including some of the poorest communities in the country. Cotton is a particularly important export commodity, contributing 10% to the GDP and 55% to foreign exchange earnings of the country.

On the other hand, overuse of water for agriculture means limited flow for people and nature downstream in the Indus Delta, impacting on ecosystems, people and species, which ultimately leads to the water economy running dry. According to estimates, the water shortage in the agricultural sector will be 29% by 2010 and 33% by 2025. The water table is rapidly dropping every year: in Islamabad, it has dropped more than 50 feet since 1986 and more than 20 feet since 1993 in Lahore. These facts put an agricultural country like Pakistan at the brink of physical water scarcity.

Thus the overall objective of WWF - Pakistan behind this initiative was to “ensure sustainable sources of clean freshwater are available to support the livelihoods of poor communities in Pakistan”, in particular, helping downstream communities and small farming communities who have received a poor allocation of water, by promoting Better Management Practices so that they need less water. The action set out to contribute towards this goal by providing methods and mechanisms to reduce the pollution caused by irrational use of agrochemicals, increase water efficiency (more crop per drop), ensure an enabling environment to encourage the private sector to purchase sustainable commodities for ultimately improving livelihood of farming communities.

The specific objective was that by 2010, 80% of small and large-scale sugarcane and cotton farmers in Faisalabad and Bahawalpur, who participated in project activities, apply Better Management Practices (BMPs), with socio-economic and environmental benefits, underpinned by policy and private sector mechanisms.

## **METHODOLOGY**

To achieve the specific objective, the initiative developed and applied better methods of growing sugarcane and cotton in Faisalabad and Bahawalpur.

These are BMPs which are agricultural practices, optimising the three pillars of sustainability: social responsibility, environmental integrity and economic viability by marrying together the financial requirements of agriculture, such as high yield, with environmental and social concerns, such as water and pesticide use.

For appropriate selection and dissemination of BMPs, relationships / partnerships were developed with different public sector institutes during the early stages of the initiative, namely; the Ayub Agriculture Research Institute (AARI); University of Agriculture, Faisalabad; Nuclear Institute of Biology and Genetic Engineering (NIBGE); Central Cotton Research Institute (CCRI); Agronomic Research Institute (ARI); Lahore Compost; Shakarganj Sugar Mills; and government departments.

The BMPs developed at research centres were then subsequently tested in a number of farmer fields, to check their suitability in different areas and soil types. These trial plots were established in Bahawalpur for cotton and Faisalabad for sugarcane. The trials tested a wide range of techniques and approaches, examining: different indigenous innovative fertility, pest and irrigation management techniques; susceptibility to different soil types; use of compost to enhance fertility, seed rates and plant population; types and methods of fertilisers; bio-pesticides; Integrated Pest Management (IPM); harvesting; and marketing techniques. Farmers' profitability was captured and recommended packages of BMPs for sugarcane and cotton determined.

#### **Participatory Approaches for the Implementation and Dissemination of BMPs:**

Training of Facilitators (ToF) and Farmer Field Schools (FFS) were established in project areas as an effective means for the dissemination of BMPs. The Training-of-Trainers approach was used to strengthen the capacity of a number of farmers to become graduate Master Farmer Facilitators (MFF). The MFFs subsequently facilitated fellow farmers in understanding their localized issues and the solutions available through adopting the most appropriate BMPs.



The FFS approach is used to gain the initial support of BMPs by a core group of farmers in a small area, and to convince them of the benefits, as they see the results for themselves and go through a supported process of learning and discovery. In a FFS, farmers are trained through Farmer Participatory Technology Development and Dissemination (FPTD&D), during which farmers learn how to make and record detailed observations, how to conduct simple experimentations to solve complex issues and learn to analyze and interpret the results of the findings. It is an intensive approach, with groups of farmers coming together regularly during the cotton season, facilitated by a trained facilitator (a

fellow farmer) to assess different BMPs, and discuss problems and their solutions. The trial and demonstration plots are essential to validate the BMPs, and show the results to farmers and others in a participatory way. Recommendations on BMPs are therefore based on a scientific analysis.

The approaches are field-based and participatory where each setting has its own ground realities; problems and solutions; and farmers must be equipped to best address their problems. Under the ToF, 25-35 participants, mostly agricultural extension agents, representatives from the local NGOs, and research institutions are trained over a cropping season. The ToF course contents are developed on the basis of problems and issues identified by experts and farmers mutually, to address all aspects of farming including the socio-cultural aspects. Some non-formal group dynamic activities are also performed in which all ToF participants work in the field with the farmers. The ToF participants observe a selected field and perform Agro-Eco-System Analysis (AESA) and discuss the observations in the field, every 2<sup>nd</sup> and 3<sup>rd</sup> day of the week, throughout the crop season.

Followed by AESA, each group (comprising five participants) of the ToF participants run 5-10 FFS (a total of 125-250 farmers). The AESA is again the basic activity of FFS, where they collect the insects, disease specimens and weeds etc., followed by drawing the figures and sharing results for further decision making. The farmers learn to organize themselves through this practice and enhance their decision making capability for their crop with help and advice of the experts. This model aims to help farmers to discover and learn about field ecology and integrated crop management starting from land preparation to right seed selection, rational use of irrigation, fertilizers and pesticides, harvesting and marketing.

For widespread expansion, it was necessary to shift from the slow process of FFS to a more dynamic and vibrant approach. Therefore, a new innovative approach of One Village One Facilitator (OVOF) was opted and tested on a small-scale during 2008. Due to encouraging results, this approach was applied across the board during 2009. The OVOF approach is based upon:

- Participatory Discovery Learning Process (PDLP);
- Outreach and Technical Backstopping (OTB);
- Quality Assurance and Monitoring Mechanism (QAMM);
- Feedback Mechanism (FM);
- Continuous skill enhancement and capacity building of Expert Facilitators and farming communities;
- Farmer Self Assessment Mechanism (SAM).

Under OVOF activity, the Facilitator is based in a village and facilitates implementation of different BMP activities in collaboration with local Activists. Normally, one Facilitator facilitates around 200 farmers covering an area of about 2000-2500 cotton acres in the area where majority are smallholders. In the case of large land holders, a facilitator facilitates maybe 1-7 farmers only. The activities normally involve the establishment of learning plots, weekly ecosystem analyses by farmer groups, discussion and decision making.

These participatory approaches were used for the empowerment of the farmers with an understanding of the agro-ecology of their own fields. Moreover, these approaches has addressed the skill development program enhancing capacity of the farmers towards observation, analyses, interaction between different factors, developing and establishing simple experimentations based on their own hypothesis and making the right site-specific management decisions. In this way farmers become active learners and independent decision makers through a process of learning by doing; which has helped in increasing their income and improving their livelihood.

There is an in-built mechanism of quality assurance and monitoring followed by technical support. In the case of persistent weaknesses, specialized capacity building workshops are organized by inviting experts from Premier Research Institutions and Universities. Another activity which is conducted on regular basis is feedback meeting on fortnightly basis to review the progress and discuss the current issues. The BMP programme has become a complete community mobilization activity.

### **Dissemination and Promotion of BMPs (Batter Management Practices):**

Once a package of BMPs had been determined for each crop, through its validation in collaboration with research institutions; these were disseminated among farmers. BMP outreach activities have included broadcast of a documentary, published adverts, posters, brochures, BMP calendars, 31 field days (attracting around 17,500 farmers), 34 BMP street theatres and 3 wrestling (BMP Dangal) events with BMP promotion (attracting around 7,500 people from 3 villages). These activities also targeted other neighboring districts as well besides the project districts.

### **Women's Open Schools:**

The project has also realized the fact that 100% cotton is been picked by women and their indispensable character in agrarian culture; where they work side by side in the field with their men. These agrarian women are exposed to number of serious health issues including, poor health and



hygiene, non availability of clean drinking water and pesticides exposure in the field. WWF – Pakistan took an initiative to enhance socio-economic conditions of the rural women along with guidance for pesticide risk reduction activities.

### **Activation and Strengthening Farmer Organisations:**

The Kissan Welfare Association (KWA), an umbrella farmer organisation in Bahawalpur was further strengthened and was actively involved in project activities. The participants of Training of Trainer (ToT) activities in Bahawalpur were also supported in organising themselves into the 'Kissan Dost Organisation (KDO)' duly registered with Social Department. During 2009, the Kashtkar Development Organisation (KDO) was also established to develop positive competition among the farmer organisations regarding the wider dissemination of better practices. This organisation has both male and female members.

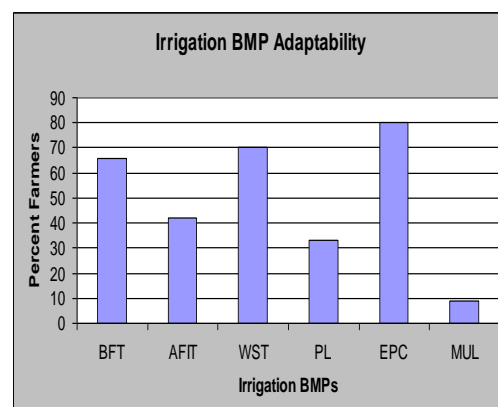
The initiative also facilitated the conversion of the FFS established during 2006-2009 into Farmer Organisations; around 60 FFS in Bahawalpur and 09 in Faisalabad were converted into Citizen Community Boards (CCBs) and these have been registered with district government under local government acts. Around 50 of these CCBs participated in capacity building workshops to help them in developing their plans.

### **Financial Mechanism for Small-scale Farmers:**

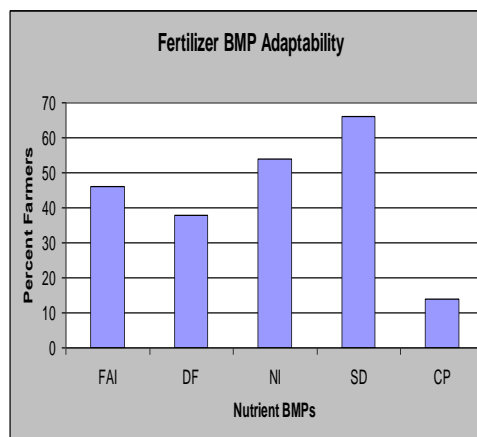
To explore financing options for BMP implementation by small-scale farmers a study was compiled based on financing schemes available from various institutions. This study provided information on loan schemes and their likely rates of return on investment. A brochure on micro-credit was developed and distributed to farmers through the Agriculture Extension Department and through field days and open days. Linkages were also developed to facilitate access to credit by community organizations. WWF - Pakistan aims to continue, to encourage banks/financial institutions to enable easier access to credit for small farmers.

### **Reviewing National Agriculture Policies:**

Under the initiative, the current agricultural policies for cotton and sugarcane were reviewed. Document for cotton and sugarcane were developed separately, with set of recommendations to the government, which if implemented, will further help in BMP promotion. The documents were finalized after organizing consultative workshops with members of



the Project Advisory Committee (PAC) e.g. the Ministry of Food and Agriculture (MinFA); Pakistan Society of Sugar Technologists (PSST); All Pakistan Textile Mills Association (APTMA); Provincial Agriculture Department; Ayub Agriculture Research Institute (ARRI); Cotton Research Institute; Sugarcane Research Institute; Pakistan Agriculture Research Council; Central Cotton Research Institute; Farmer Association of Pakistan (FAP), Lahore Compost; sugar mill representatives; and the Pakistan Cotton Ginners Association (PCGA). Beside these PAC members, the Water and Power Development Authority (WAPDA); the Federal Flood Commissioner (FFC); the Irrigation Department, the Ministry of Environment; and the Indus River System Authority (IRSA) also participated in policy related workshops.



#### **International support for BMP uptake:**

The project has contributed to the development of criteria under the Better Cotton Initiative (BCI) and the Better Sugarcane Initiative (BSI), which started as global multi-stakeholder roundtables concerned with the environmental and social impacts of production. The BMPs developed through this initiative will help farmers to meet these global criteria.

## **RESULTS**

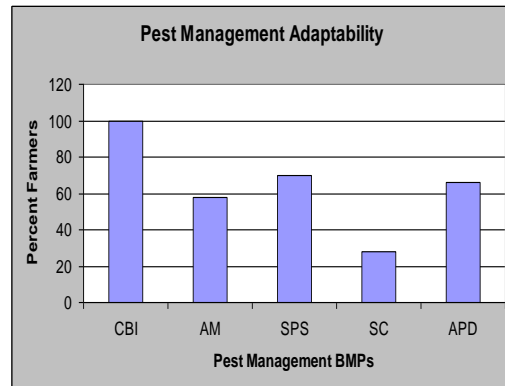
WWF - Pakistan carried out a socioeconomic impact evaluation of BMPs in 2009, based on the Sustainable Livelihood Framework (SLF) approach which examines financial, physical, natural, human and social capitals. The study revealed a comprehensive improvement in all these capitals among the BMP farmers.

#### **Fertility Management:**

Different techniques were applied for fertility management which include fertilizer after irrigation, side dressing, using nutrient indicators, composting and split dosing. Comparing adaptability, side dressing technique was adapted by around 65% of the farmers, nutrient indicators by 53% farmers and fertilizer after irrigation by 46% farmers. Using compost at the time of land preparation helped in reducing the use of synthetic fertilisers by up to 50% without affecting the seed cotton yield. Utilisation of nitrogen fertiliser after irrigation helped in optimisation of fertiliser use up to 37%; and increasing plant population from six to nine inches helped reduce irrigation water by 25% due to decreased evaporation. Under trial on soil fertility, nitrogen fertilisers applied in split doses, based on nutrient

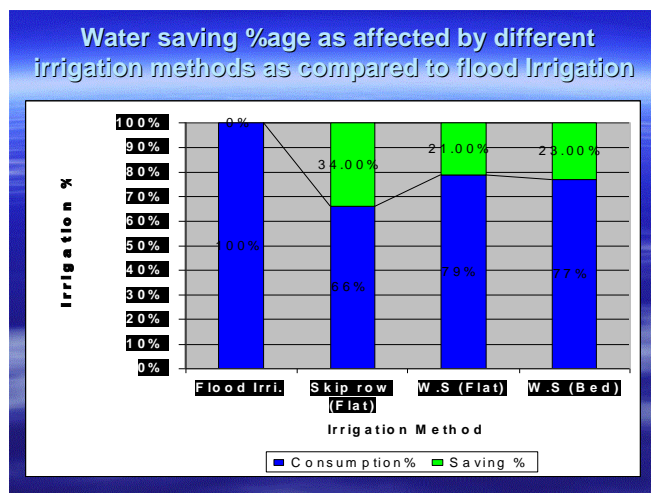


deficient indicators gave 13.9% better seed cotton yield as compared to conventional techniques. Similarly, fertiliser placement trials gave 16% better yield as compared with broadcasting technique of applications. Both the above trials showed saving of around 33% of fertiliser and overall cost-benefit ratio was 1:2.27 in comparison with 1:1.99 in conventional plots.



**Irrigation Management:**

Flood irrigation is a conventional method for most farmers. For better irrigation management, other techniques applied were; water scouting, alternate furrow irrigation, bed and furrow, levelling and mulching. These techniques gave substantial reduction in water consumption without effecting the crop and overall yield. Number of replications and widespread implementation of these techniques proved that Bed and Furrow Technique saved around 31% irrigation water, Alternate Furrow Irrigation Technique saved up to 35%, Water Scouting Technique resulted in 22-27% reduction, Proper Leveling up to 40%, Enhancing Plant Canopy up to 24% and Mulching saved up to 30% of the irrigation water. Comparing adaptability, bed and furrow was adapted by around 65% farmers, alternate furrow irrigation by 40%, water scouting by 70% and enhancing plant canopy by 80% of the farmers.



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**Pest Management:**

The pesticide usage in Pakistan increased from 665 tons in 1980 to more than 50,000 tons during 2007 with 75% of all the imported pesticides applied on cotton crop (PAPA 2005). The excessive uses of agro-chemicals have led to enhancing green house gases emission resulting in increasing the carbon footprints which represent the total amount of greenhouse gases produced to support human activities, directly or indirectly, usually expressed in equivalent tons of carbon dioxide (CO2). All these have severely affected the overall ecosystem of the Mother Nature.

Different indigenous techniques were applied to minimize the pesticide usage, including conservation of beneficial insects which resulted in up to 60% reduction, using alternate material such as neem and bitter melon extracts which resulted in 40% reduction, sanitary and phyto-sanitary activities, which is based on elimination of pests and their alternate host plants before the cotton sowing and during the cotton season. This technique resulted in up to 60% reduction and this was particularly successful in case bollworms & mealy bug, use of semi-chemicals for bollworms, resulted in up to 30% reduction and adjusting pesticide dosages, resulted in up to 50% reduction, particularly for mealy bug control.

Similarly trials were established on sugarcane bio-pesticide reduce the stem borer infestation in sugarcane by 33%, conserving biodiversity of beneficial insects facilitate optimization of pesticide use up to 66% and trash mulching in sugarcane has three impacts; saving of at least two irrigation and half bags of urea and less infestation of various sucking and boring pest due to conservation of beneficial insects. This also has positive impacts on soil structure.

#### **Widespread BMP dissemination:**

During the first three years of the project, in total 92 Farmer Field Schools (FFS) were established in Bahawalpur for cotton involving 2,143 farmers. The BMP cotton farmers were able to reduce their use of irrigation water by an average of 38% when compared with non-BMP farmers, synthetic fertiliser by an average of 39% and pesticide use by an average of 47%. Average cost-benefit ratio of BMP farmers was 1:1.82 compared with 1:0.9 for non-BMP farmers. Similarly, gross margins obtained by BMP farmers were 55% compared to 43% for non-BMP farmers. In quantitative terms, around 66,000 litres of pesticides were eliminated in sub-district Bahawalpur. The same is true with synthetic fertilisers; roughly 37,800 bags of 50kg fertiliser were saved in sub-district Bahawalpur.

In Faisalabad 32 FFS were established for sugarcane with 800 participants. The sugarcane farmers made crop management decisions which led to reductions in the use of irrigation water by 18%; synthetic fertilisers by 25%; and virtually 100% of all pesticides were eliminated. On average, the cost-benefit ratio was 1:3.2 for BMP farmers compared with 1:2.5 for non-BMP farmers.

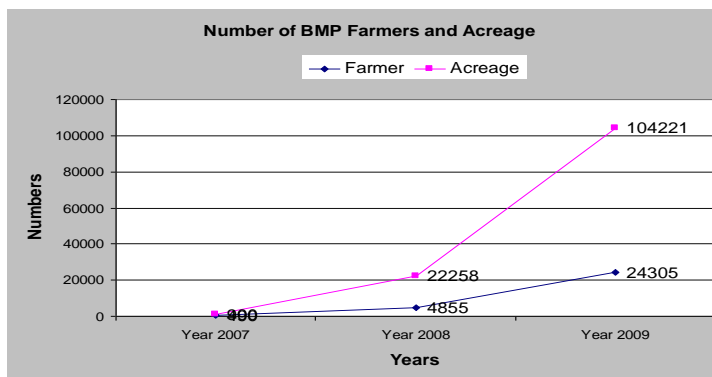
Summary of average BMP results among Farmer Field School participants

<b>Crop</b>	<b>Sugar-Faisalabad FFS</b>	<b>Cotton-Bahawalpur FFS</b>
Number of farmers	800 (32 villages)	2143 (92 villages)
Average fertiliser reduction	25%	39%
Average water reduction	18%	38%
Average pesticide reduction	almost 100%	47%
Cost-benefit ratio	1:3.2 BMP/1:2.5 non-BMP	1:1.82 BMP/1:0.9 non-BMP

For widespread BMP dissemination, a more robust One Village One Facilitator (OVOF) approach based on outreach and advisory services was applied. During 2009, around 24000 small and large holders were engaged in the activities and these farmers applied BMPs over 100,000 hectares of cotton. These farmers made crop management decisions which led to substantial reduction in inputs and increasing overall gross margins. Around 32% less water were utilized by BMP farmer as compared with Non-BMP farmer. Similarly, in case of chemical fertilizers, 32.66% less synthetic fertilizer were applied by BMP farmer as compared with Non-BMP in 2009. Moreover, in case of synthetic pesticides, the BMP farmers applied around 72% less synthetic pesticides were used by BMP farmers as compared with non-BMP.

### Women's Open Schools:

The trained women under WOS were provided with special gloves and masks to protect them from pesticide exposure. Moreover, they were also trained to build and use better smokeless stoves (*Maholyati Chohla*), which has resulted in 35% saving of wood, so as to avoid number of environmental and health issues concerned with the smoke and ash. In Bahawalpur and Faisalabad 38 Women Open Schools (WOS) with more than 1200 participants were established. The curriculum was developed through stakeholder workshops. In addition to pesticide risk reduction activities, strong components of health and hygiene, and income generation were incorporated. The trained women were able to grow organic vegetables in kitchen gardens, using homemade compost made of organic household waste.



### DISCUSSION

The results of the action have proved that water savings of between 18-38%, fertilizer savings of 25-39% and pesticide savings of 47-100% are possible by adopting very simple and easy to apply site specific BMPs. This has been achieved through enhancing skills of smallholders<sup>1</sup> and public extension services and bridging the gaps between these smallholders and extension services

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<sup>1</sup> Small scale farmers

through District Sustainable Agriculture Committee (DSAC). At the wider level; the connection between State Agencies and Research Institutions has been ratcheted to a higher level. The exposure of the Agriculture students to evidence-based-agriculture methodologies is likely to be continued. The Thirsty Crops Project, being a very small action, will not have profound impacts on overall agricultural system of the country but its results provided an opportunity, a baseline, for its replication over a larger area to get the desired results. The action has also helped in enhancing the natural ecosystem and maintenance of soil health through practices like trash mulching in case of sugarcane and reduce pesticide applications in case of cotton; and it will further contribute towards safeguarding farmer livelihoods as each year fertile soil is lost due to salinisation and sodicity caused by poor management practices.

Socio-economic and case studies have shown that BMP activities have had a range of positive impacts on the lives and livelihoods of the farmers, and their families, their communities. The improved financial situation of farmers, pickers, and households, coupled with the improved knowledge about health and hygiene is reflected in improved health of women and children - while reduced sicknesses from improved household practices decreases the financial burden of sickness. The action has facilitated establishment of farmer organisations at grass root level with major role of coordinating agricultural activities in the community and for better linkages with the service providers.

Considering the importance of financial support for implementation of BMPs, the action has facilitated development of an agreement with financial institution for provision of soft credit facility for BMP implementation. The consultative process to convert the existing policies into a supportive policy framework has been initiated. At the national level, the long term changes sought by this project have yet to materialize, however connections have been made, initial positions and papers have been drafted, and common positions (and areas for further debate) staked out. The pressure has already been raised for the reform of international policies on cotton and sugar through consultative processes of BCI and BSI.

WWF - Pakistan has undertaken a range of freshwater conservation activities in Pakistan for many years. Across these areas of work, there is a desire to scale up WWF – Pakistan's engagement in project activities to increased commitments of key national and provincial policies that drive water sustainability in the Indus. To this end the status quo on the National Water Policy, policies relating to allocation of water, water infrastructure management policy and environmental flows policy were sought out and analyzed. Moreover, National Agricultural Policies for cotton and sugarcane were also studied and

recommendations were made to the Government for its improvement after discussing with stakeholders through organising workshops and seminars.

Using international best practice recommendations and consultations with stakeholders, the following requirements were discussed, validated and strengthened:

1. Improving water productivity & minimizing water conveyance losses (OFWM);
2. Water efficient crop cultivars;
3. High Efficiency Irrigation System;
4. Revised water (re) allocation at the provincial level harmonizing water availability to cropping patterns;
5. Recognition and allocation of environmental flows coupled with equitable and environmentally/socially/economically sustainable storage;
6. National Water Policy should be approved and notified at the earliest;
7. More emphasis on governance rather than government.

The encouraging fact is that an increasing number of company CEOs are voicing their commitment to sustainable development and the specific actions they are taking. They appreciate that there are sound business reasons to identify and adopt more sustainable production and processing practices. A number of large industrial consumers of Cotton like Ikea, Chenab Group, and potential international brands consuming sugar, want to be able to certify that ingredients in their products are produced by means of sustainable practices like BMPs.

Now the stage is set where all the relevant stakeholders from smallholder at micro level to policy maker at macro level are fully involved and charged to take the action further for bigger impacts through devising and implementing favorable pro-poor policies. This action, when magnified, will have impacts at national and regional levels due to the competition at international market for better products and formation of sustainable market. This therefore, will make the business community understand their sustainable role in protecting Planet Earth, hence their future.

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