Study of Research and Extension Issues in the Sichuan Province of China for Farm-Level Impact on the Productivity of the Rice-Wheat System

Background

The national agricultural research systems (NARS) of South Asia, together with the Rice-Wheat Consortium (RWC), an eco-regional initiative, have been addressing the critically important challenges of food security, natural resource conservation and poverty alleviation in the Indo-Gangetic Plains (IGP). The last two years have witnessed swift and accelerating adoption of productivity-enhancing and resource-conserving practices that reduce carbon emissions and input-use and improve resource quality, while raising system productivity and farm-level profits. Fine-tuning of research and extention practices is a continuous process of interaction. To learn from the Chinese experience, the RWC organized a traveling seminar for select regional scientists of the IGP (Annexure I) in the Sichuan province of China from 23–30 May, 2000.

The itinerary, comprised visits to farms, research institutes, agricultural academies, bureau of agricultrual machinery, and manufacturers of agricultural machinery and small-farm equipment (Annexure II). In addition, there were semi-structured discussions, and presentations by the Chinese experts. The team members also met a number of senior-level Chinese experts and other officials (Annexure III).

The following pages summarize reports, discussion notes, travelogs as well as the information received by the team members on various issues from the Chinese experts.

Over 90% of the rice area in Sichuan province in China is grown to hybrid rice. The main reason for the high adoption of hybrids is the

Participants of the traveling seminar on a field visit in Sichuan province of China.

relatively low area of land suitable for rice cultivation (less than 10% of the total area) and therefore the emphasis is on quantity rather than quality production of rice (local non-hybrid rice has better eating quality than hybrids and is sold in the market at significantly higher prices). The cropping intensity is also very high (at about 2.78). In Southern China and in the Southern Yangtze River floodplains, rice-rice-wheat (or barley or rape or green manure) cropping systems are practiced. Therefore, available turnaround time is very short. In Sichuan province, this is true even for rice-wheat systems because of low temperature limitations.

Seeds of hybrid rice in China are produced and sold by Government agencies. The private sector has not yet been allowed to produce and sell hybrid seeds. Another important observation is that labor cost is relatively high and increasing. Currently, in Sichuan province, an agricultural laborer costs about \$2.5 day^{-1} during slack periods and \$3.75 day^{-1} during peak times. For comparison, market prices for a few commodities are given: milled hybrid rice is \$0.25 kg^{-1} while normal rice is \$0.44 kg^{-1}; hybrid paddy rice is \$0.15 kg^{-1}; and urea \$0.19 kg^{-1}. Therefore, farmers are increasingly interested in land- and labor-saving technologies.

Multiple Cropping and Cropping System

Between sowing of wheat and harvest of rice there are 60–85 free days. In order to use this period, the following cropping system has been promoted in the province: Rice—autumn crop (GM/sweet potato/soybean/corn/potato)—wheat/ rapeseed mustard. Rice harvest is advanced by planting rice early in the season and not allowing sowing of autumn crops and wheat/rape to be delayed.

Commentary: More emphasis is placed on timely sowing of crops and using manual labor in Sichuan province. Machines are not used much. Only small-scale mechanization is allowed or practiced. Bed-planting was not seen despite very obvious advantages. We saw rice seedlings raised in plastic sheets of small cups and broadcast in the main fields after harvest of rape/wheat in zero-tilled conditions. Weed control was manual, combined with chemicals. The seedlings were seen floating on the water surface, sometimes even hanging on wheat stubbles as the soil pallet had broken down during throwing. The economics of the technique, even in China, did not seem to be favorable. The term members were given different versions of the cost of this technique by different people, and so there is a need to evaluate it in South Asia.

Wheat Establishment Techniques in Sichuan Province

In Sichuan province, wheat is sown by two major methods: (i) dibbling and seeding after rice in conserved moisture, and (ii) mechanical plowing and seeding. The various techniques include the following:

- Reduced tillage – straw removed/burned (manual harvesting or combining) close to soil surface.
- Combine-harvesting and stubbles chopped to produce mulch.
- Surface seeding of wheat and mulching.
- Zero-tilled wheat.
- Making a hole manually and sowing wheat seeds – this technique closely resembles zero-tilling technique. Rice straw used as mulch.
- Traditional plowing and planting.

Cultivation techniques of wheat in rice-wheat system in Sichuan

Surface seeding of wheat and rice straw mulching saves 22% costs, increases yields by 10%, saves 23% labor and increases farmers' income by 35%. Compared to dibbling, it saves 53% labor, increases yield by 4%, saves 20% costs and increases farmers' income by 10%. Surface seeding with mulch reduces evaporation and provides a better temperature regime for germination. Mulch also returns nutrients to the soil and lowers weed growth making the system highly efficient and sustainable. In surface seeding the selected cultivars should be resistant to lodging. Mulching controls weeds if practiced for several years. In the initial stages, however, chemical weed control is needed using a contact herbicide like *Paraquat* or a systemic one like *Glyphosate*, one week before sowing of wheat, if weeds are a problem. Post-emergence herbicides are also used when needed. Surface seeding is also increasingly done with a 2BJ-2 manually pulled seeder in lines. The level of mechanization in Sichuan province is very low. Wheat production largely depends on animal power and or manpower.

Rice straw mulching : Farmers apply whole straw to the main fields after some decomposition in heaps, but the practice is not much favored. Generally, the rice straw/stubbles are chopped into 10–20 cm pieces and then applied to the main fields, a few days after sowing of wheat.

Commentary: Using a zero-till drill machine, wheat can be sown into anchored rice straw of variable height. Using a stubble shaver in controlled traffic wheels, rice straw can be chopped into small pieces and spread to create surface mulch. The wheel tracks can be used as controlled traffic lanes for all subsequent farm operations in the main crop season and also for making irrigation channels. The irrigation channels serve as ditches for drainage of excess water. Irrigation channels are placed after every

A view of a bumper surface seeded wheat crop in the Sichuan province. Inset picture shows rice straw mulching and precision surface seeding.

Irrigation-cum-drainage channels technology is commonly used in rice-wheat system in China for efficient control of water application.

9–11 rows of wheat sown with zero-till. The irrigation channel is 20–cm deep and 30–cm wide at the top. Farmers prepare irrigation-cum-drainage channel in fields for efficient control of water application. The methods being practiced in Sichuan province are labor-intensive so as to provide work for local farmers.

Irrigation practices: In Sichuan province, rice fields, particularly in the hilly areas, are wet and, therefore, do not need to be irrigated for seeding of wheat by surface seeding. When the surface is too dry, a light irrigation before seeding is given to promote seed germination and seedling growth. Usually, farmers irrigate fields two days before sowing to provide optimum moisture for surface seeding of wheat from October 20 to November 8. The plant density is optimal between 225–255 plants m^{-2}.

Commentary: The zero-till machine without furrow openers can also be used for line sowing of surface seeded wheat in South Asia.

Fertilizers: The recommended fertilizer doses are high at 150–180 kg N, 45–175 kg P_2O_5 and 85–135 kg K_2O per hectare. Nearly 70% of the N is applied as a basal dose, with 20% at jointing/booting stage and 10% at the milk stage. N is applied broadcast before covering the seed with mulch, or dissolved in water or organic manures and sprayed after mulching. The later is preferred. Basal fertilizers are applied as a surface broadcast in wet soil before mulching and seeding. NPK are also mixed with FYM and broadcast. Mulch is not applied very thick as it influences seed germination adversely.

Chemical sprays for control of crop lodging: In order to control lodging and promote yield, it is considered crucial to spray CCC (an hormonal chemical) at early tillering. Generally 1.5 liter of 50% CCC is dissolved in 400–600 liters of water and sprayed. This chemical reduces height by 5 cm without affecting yields.

Zero-tillage and wheat production

Zero-tillage increased wheat yield by 7.7–9.7%, saved 90–120 man-hours and production costs by 300–450 Yuan ha^{-1} (Tang Yonglu *et al.* 2000). It is estimated that 146,600 ha wheat is sown with zero-tillage in Sichuan province. Some of the advantages listed by the farmers are as follows:

- Zero-tillage increased capillary porosity and reduced non-capillary porosity.
- Zero-till fields had higher moisture and water-holding capacity than other systems.
- Zero-till had 2.2–4.6% higher seedling emergence.
- Seedling emergence was advanced by 1–2 days.
- More secondary roots were formed and plants were more resistant to lodging.
- Plow layer is more fertile than deeper layers.

Rice Cultivation Techniques

Chinese farmers practice rice cultivation with nurseries raised by the dry seedbed method. Seedlings are covered with mulch and raised in bamboo poly-houses before exposing to sun several days after seeding. Rice seed are soaked for about 3–4 days to promote early emergence in the beds.

In the dry seedbed method, seedlings are raised on raised beds containing plenty of FYM etc. Seeds are sown in lines and irrigated with a watering can, rather than watering by peripheral channels, which provides water that subs into the beds. This keeps the bed loose and friable, reduces compaction and allows more root growth. Three different types of nurseries are used for transplanting: 4-leaf stage; 6-leaf stage, and 7-leaf stage for fallow/GM fields, winter fallow fields, and wheat fields, respectively.

Rice nurseries are sterilized by spraying 2.5g of "fen-aminosulf" dissolved in 2.5 liters of water for each square meter of bed. When seedlings are at the 2-leaf stage, the treatment is repeated for control of wilt diseases. At the 3-leaf stage, urea and KCl is applied as a top dressing. Planting density for small and medium size seedlings is kept at 210,000 to 255,000 per ha in the main field. For large seedlings, the population is kept at 150,000. Shallow water is kept at the heading and flowering stages and no irrigation is applied 7 days before harvest.

Flexible plastic trays for broadcasting rice nurseries

Seedling establishment by broadcast (throwing), in Guang Hai, Sichuan Province. One of the main activities pursued during the visit to Chengdu (Capital of Sichuan province) and surrounding areas was to study the broadcasting method of planting rice seedlings. The method was demonstrated and explained to us by scientists of the Crop Research Institute (CRI), Sichuan Academy of Agricultural Sciences (SAAS), who are working on the method and its promotion to farmers.

The broadcasting of seedlings basically consists of raising the seedlings in special trays made of PVC and throwing them in a bunch manually, using an upward motion of the hand, on to the puddled field or by use of a blower device. This is a method targeted to replace the traditional labor-intensive transplanting method.

Raising seedlings in PVC trays

This method requires seedlings to be raised in PVC trays that contain shallow depressions or "cups". Each cup is about 2 cm in diameter at the top, 1 cm at the bottom and 1–1.5 cm deep, and has a cross section like that of a cone.

Broadcasting method of planting rice seedlings in Guang Hai, Sichuan province. It consists of raising seedlings in specially bubbled PVC trays (*Left*), and throwing seedlings in a bunch manually or with the help of a blower on the puddled field *(Right)*.

There is a small hole at the bottom for drainage. In each cup, 2–3 seeds are placed before filling with nutrient-enriched and organic-matter-enriched soil. They have developed a sieve-like device to put the right number of rice seeds into each cup in one motion. A tray can be of any size that is convenient for carrying and using in the field. In Sichuan, the trays were about 60 cm × 30 cm in size. Seedlings are grown in the trays on beds using the “dry seedbed method” in which irrigation water is given in light amounts and are never submerged (as opposed to the “wet seedbed method” in which the seedlings are always kept wet or submerged). This method was first introduced in Sichuan from Japan and is now widely used by farmers. The rice roots penetrate the small hole at the base of the tray and get nutrients and water from the bed. CRI, SAAS, is making a video of the method with instructions in English (we watched the Chinese version video) for the RWC. Also videos are being made for surface seeding of wheat with mulching.

The 20–25 day-old seedlings, grown in the trays, are taken to the field (like the “dapog” seedlings in the Philippines) and seedlings are broadcast to the puddled field manually or using a blower machine (a knap-sack device using a mechanism similar to that used for spraying pesticides). In the manual system, several bunches are lifted from the tray (the seedlings get removed from the cups easily without shearing of roots) and thrown into the field at the target spot. With the blower, seedlings from the tray are pushed toward the inlet of the blower pipe steadily, while the blower outlet is directed to the target spot. In both cases the seedlings land on the field with their roots down (the soil attached to the roots make it bottom-heavy and when thrown it flies like a missile with roots landing first). Most of them are not vertical when they land, but they become vertical in a few days as a consequence of plant characteristics. In both the manual and blower-driven system, some gap filling is done later to have a more even distribution of the seedlings. The plant density maintained varies between early-rice and late-rice crops depending on the soil fertility level. In South China, where rice fields have high soil fertility, 22–23 seedling-drops m^{-2} is used for early rice and 24–26 seedling-drops m^{-2} for late rice (each drop has 2–4 tillers) (Zhen 1998).

A unique aspect of the seedlings raised in trays is that each seedling hill grown in a cup grows 2–4 tillers before they are ready for transfer, which are established in a hill in the main field. The plants in the tray look very healthy, with strong culms and short stature. It is claimed that this has advantage in terms of time to complete the vegetative phase, resistance against lodging and helps to increase yield. Some chemicals are also sprayed to keep the seedlings height low in the tray.

After broadcasting of seedlings, some additional manual labor is required for "gap filling" in the field, which is done by observation. There is a claim that, after establishment, the plants do not become yellow or suffer from any transplanting shock that is usual with the conventional transplanting method.

A farmer is seen filling the gaps manually in Guang Hai, Sichuan province after broadcasting rice seedlings.

Advantages of the method

The reported advantages over the traditional manual method of transplanting are:

1. **Saves labor.** The daily labor cost is increasing significantly. According to Shengxiang Tang (personal communication), a farmer can cover about 10 times more area (0.33–0.5 ha) per day by manual broadcasting of seedlings compared to traditional transplanting. When the blower machine is used, the coverage per person is even higher.

2. **Saves time.** The crop is established earlier because less labor is needed. This is of critical importance in areas of intensive land use.

3. **Yield is higher.** A national survey showed that 573 kg ha^{-1} higher yield is achieved by using the broadcasting of seedling method compared to traditional transplanting. The reported reasons in favor of broadcasting are: early tiller development, better root development and more "effective panicles".

4. **Saves land area used for seedbeds.** Tang reported that with PVC trays (60 cm x 33 cm each), about 500–600 m^2 is required for 1 ha of rice establishment. For manual transplanting of 1 ha by the traditional method, the seedbed area needed is about 1500–1600 m^2 (Liu 1998). It is also possible to use a stack system or racks to save on nursery area.

5. **More economic benefit.** The above translate into a higher return for the farmer. Reported farmer income benefits accruing from broadcasting of seedlings was \$185 ha^{-1} in Fujiang province (Su 1999) and 15–36% more in Zhejing province (Xu 1998). An earlier national survey showed an average of \$93 ha^{-1} more income in favor of the broadcasting method (MOA 1997).

In one publication there is a claim that in the whole of China, about 11% of the rice area, or 3.3 million ha of rice is now established by using the broadcasting of seedling method. In 1991, only 1200 ha were under this system.

One hectare of rice planting requires 750 trays each with 434 plugs with 2 seed for hybrid rice and 3 seed for HYV rice varieties. No root pruning/twining is practiced before transplanting. It was advised to have 10% more plugs to allow for uneven distribution, poor upright stand, floatation due pallet breakdown and other problems with stand.

Limitations of the method

Not all varieties are suitable for broadcasting of seedlings. Varieties with longer growth duration and higher plant height are usually considered unsuitable. Poor land preparation and uneven field level may result in less production and wipe out the expected benefits from this method. Weed control is more difficult in broadcast seedling methods and is more dependent on herbicides than traditionally transplanted fields. This may reduce the efficacy of weed management, or increase the cost of weed control, especially if herbicides are not available at competitive prices. Moreover, if environmentally toxic herbicides are used, they can damage the natural environment and affect human health. The techniques seem to suffer from floatation of seedlings, uneven distribution and non-uprighting of seedlings, which is done manually several days after broadcasting in puddled and non-puddled zero-till situations. The plastic film longevity is less than two seasons and films become brittle in some situations. Labor costs for raising seedlings was high. Obviously, it needs to be tried under the conditions of the sub-continent. The benefits of timely rice transplanting may outweigh all the above problems. The major issue in obtaining high yields of hybrid rice revolves around getting 4–5 tillers in rice nurseries and this is possible only through line seeding of rice or raising the nursery in trays.

Seedling established in zero-tilled lands (Tai He, Chengdu, Sichuan)

This practice consists of making holes (270,000/ha) in zero-tilled soil (which is pre-saturated to make it soft enough) with a stake and putting the 40-d old seedlings manually in the holes. It is a labor-intensive planting method (as reported, all labor is usually provided from the family, hence no cash cost is involved) but it saves tillage cost ($ 112 ha^{-1}, custom service) and tillage time. However, in general, yields from this method may be lower. On balance, this method may still be attractive in some situations. In Tai He area, zero-tilled rice (hybrids of 140–150 days maturity) and zero-tilled wheat are being grown in the same fields for 8 years now. Yields are reported to be high (9 t ha^{-1}) for rice and 5 t ha^{-1} for wheat. No major disease problem was reported. Rice matures in 140–150 days, but wheat, which is grown in the winter, takes longer to mature (180–185 days).

Agricultural machinery (Guang Hai, Sichuan; and Beijing)

We visited an agricultural machinery manufacturing company and saw a display of equipment, including small powered tiller-cum-seeders and large combine harvesters, outside of Chengdu City. The tillers-cum-seeders are basically the same type as in Bangladesh and Nepal, with a 6-row seeding device that were imported from China.

Because of increasing labor costs, use of agricultural machinery is rapidly increasing in Sichuan province. About 85% of wheat and 60% of rice are thrashed by machine. Machines harvest about 60% of rice and 75% of wheat fields. Combine harvesters are gaining popularity. A combine harvester, with a 48 HP diesel engine and a capacity to harvest 1.8 ha of rice or 2 ha of wheat per 8-hr day, costs about $7,000. Farmers are getting the service through custom hiring. In Sichuan province, the hiring rate for harvesting is about $94 ha^{-1} (which is equivalent of 25 man-days of labor). The increasing popularity of its use was manifested by the fact that the manufacturing company we visited had sold 40 units of combine harvesters in the past one year. It was recognized that Chinese farm machinery could play an important role in addressing the small farmers' needs in the rice-wheat region, especially Bangladesh and Nepal where land holdings are relatively small.

Puddler-cum-leveler

Several operations are required for good puddling and leveling. The Chinese have a puddler-cum-leveling machine that completes both the operations simultaneously in one pass of the tractor. The machine is similar to the one developed by a farmer Mr Jagbir Mann of Karnal district in Haryana. Information about it is already available on the RWC website: http://www.rwc.cgiar.org. The Chinese machine has a shocker as well as a tension spring for loading/unloading of soil during leveling. The Mann machine, although it has given good performance in Haryana, does not have the shocker for vertical buffering action of the leveler.

Water Management (Dujiangyan Irrigation Project)

Chinese farmer never wastes irrigation water what to speak of clean drinking water. Through judicious use, he increases the water use efficiency manifold. He usually avoids surface irrigation to rice nurseries but applies water by a sprinkler or by a bucket. He never over irrigates his fields.

We visited the Dujiangyan Irrigation Project in Dujiangyan city about 48 km south of Sichuan. In terms of its age, scope and scientific principle, the project can be considered as the landmark in the history of world water conservancy. The project consists of three major parts: (i) Yuzui (fish mouth), (ii) Feishayan (overflow spilling) and (iii) Baopingkou (mouth of the precious jar). The weir system diverts the fast running Min River and rechannels it into irrigation canals. Yuzui was built to split the force of the river and divide its water into inner flow and outer flow. Feishayan was built in the lower section of the dike, regulating the flowing water in the flood period. Baopingkou is a bottle-neck passage of water cut through at the foot of mountain Yulei (jade-piled Mountain). This trunk canal plays an important role both in irrigation and in flood control. The project is irrigating 3.2 million ha in West Sichuan Plain and has been expanded into a network of dams, reserviors, pumping stations, hydro-electric works and urban water supply.

Developing the Interface with manufacturers

Dr S I Bhuiyan and Dr R K Gupta attended a meeting in Beijing on 26 May, 2000 in which the Director of the Administrative Department of Agricultural Mechanization (ADAM), Ministry of Agriculture, People's Republic of China (Dr Niu Dun) and nine other MOA officials, including a few from the China Agricultural Machinery Testing Centre, were present. Discussions focused on the role of agricultural machinery in alleviating the constraints to increasing farm productivity and farmer income in the countries in the Indo-Gangetic Plains, and the possible collaborative roles that the Chinese public and private sector machinery experts and manufacturers could play in addressing them. During discussions, it was recognized that this role could be made broader and more specifically need-based through appropriate collaborative activities between China and the Consortium countries. The idea was received well. Mr Niu indicated that in China about 400 entrepreneurs were manufacturing agricultural machinery and the Government laid strong emphasis on quality control.

He also informed us that recently his Government has started a collaborative project in the Philippines, through which they would establish a center for agricultural machinery development and testing, based at the Central Luzon State University campus. In principle, he expressed interest to explore similar collaboration bilaterally with the governments of each of the countries in South Asia. After a very congenial discussion, it was agreed in principle that Peoples Republic of China will field a team of experts to study the agricultural machinery needs, demand-supply relationships, constraints, and manufacturing capacity in the region. The RWC Office in New Delhi will facilitate the activity, in cooperation with other relevant institutions. Before the bilateral programs could materialize, private sector will be promoted to interact by the Chinese Government. The Director General, invited us to attend the Agri-Drylander, Farm Machinery Trade Fair to get an idea of what China can offer to South Asia.

Chinese Membership of the RWC

As of now, China is not a full member of the Consortium. The issue of membership was explored with the Vice-President of the SAAS, Chengdu. She was requested to send the FU a formal request for full membership through the Government of the PRC. We again raised the issue during our discussions with the Director General and other senior directors in the meeting held on 26 May 2000 in Beijing. Since there was no responose, we excluded the issue from our further discussions.

Actions Suggested for Follow–up by the NARS

- All the 4 NARS should conduct agronomic research to explore if there are benefits to be gained from the dry seedbed method of nursery management, using nutrient-enriched soil that is high in organic matter. The research would test if more healthy seedlings with some tillers developed in the seedbed can be raised and result in better yields. These would also be uprooted easily causing no harm to the root system and reduce transplanting shock. This research, if successful, could make substantial improvement to the traditional seedling raising and transplanting methods.
- In conjunction with the above, physiological studies should be conducted on plant growth in the seedbed and crop establishment in the main fields to quantify the reasons and benefits of the new system.
- The seedling broadcasting method for rice establishment may have relevance for Bangladesh and Nepal. Dr Adhikari, Coordinator (Rice), Nepal, informed that it was already a practice in the Nepal Terai near Mahendranagar. The Nepal system should be looked at and compared with the Chinese method. Seedling broadcasting is one possible alternative to the traditional transplanting method, another being direct

seeding in the field. Research should be conducted to test the technical as well as economic feasibility of the PVC tray-based seedling raising system. If encouraging results are achieved, a further course of action can be identified and pursued.

- More research is required to prevent pallet breaking during the throwing action to avoid floatation of seedlings.
- Techniques for incorporation of residues of the wheat crop need to be researched to avoid burning, improve soil health and crop productivity.
- We should invite Chinese experts and entrepreneurs, involved in mechanization of small farms, and developing and manufacturing of small-farm, equipments to visit South Asia.

Acknowledgements

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Annexure I

Participants: Traveling Seminar

Bangladesh

Sadiq I Bhuiyan
IRRI Representative for Bangladesh and
Water Scientist
Bangladesh Office :
House #39, Road 23, Banani, Dhaka 1213
Tel 880 2 8827210
Fax 880 2 8825341
E-mail irri@bdonline.com

N H Chowdhary
Acting Director (Research)
Bangladesh Rice Research Institute
Joydebpur, Gazipur 1701
Tel 880 2 9350122
Fax 880 2 8823416
E-mail brrihq@bdonline.com

India

R K Gupta
Regional Facilitator
Rice-Wheat Consortium
for the Indo-Gangetic Plains
c/o. CIMMYT (India Office),
NBPGR (old) Building, Pusa Campus, New Delhi
Tel 91 11 5822940
Fax 91 11 5820800
E-mail r.gupta@cgiar.org

Nepal

N P Adhikari
Rice Coordinator
Hardinath Agricultural Form
Nepal Agricultural Research Council
Jankpur
Nepal
Tel 977 41 23000
Fax 977 1 521197
E-mial narced@mail.mos.com.np

Pakistan

Hafiz Mujeeb-ur-Rehman
Assistant Director/Agronomist
Directorate General On-Farm
Water Management, Punjab
21, Davis Road, Lahore
Tel 92 42 9200703
Fax 92 41 9200702
E-mail ofwm@lhr.comsats.net.pk

M Salim
National Coordinator (Rice-Wheat)
and Principal Scientific Officer
National Agricultural Research Centre
Park Road, Islamabad 45500
Tel 92 51 9255062
Fax 92 51 9255034
E-mail munir@rwcs.sdrpk.undp.org

Annexure II

Itinerary: Traveling Seminar

Date	Day	Activity
22 May, 2000	Sunday	Team members reach Bangkok Leave for Kunming, China Leave for Chengdu, China Stay at Wang Jiang Hotel, Chengdu
23 May, 2000	Monday	Field visit Guanhan city area to observe broadcasting of rice seedlings, dry seedbed nursery and wheat establishment techniques. Visit Bureau of Agricultural Machinery, Guanhan city. Meet Mr Chen Congliang, Director, Bureau of Agricultural Machinery. Dinner meeting with: President, Sichuan Academy of Agricultural Sciences Standing Member, Schen-Technical Committee, Ministry of Agriculture Vice President, China Society of Plant Nutrition and Fertilizer Asstt. President, Sichuan Academy of Agricultural Sciences. Night stay at Wang Jiang Hotel, Chengdu.
24 May, 2000	Wednesday	Field visit to observe zero-tillage rice after wheat, dry rice nursery raising and sowing of rice through dibbling, broadcasting of rice seedlings. Visit tractor factory Night stay at Wang Jiang Hotel, Chengdu.
25 May, 2000	Thursday	Discussions at Crop Research Institute, Sichuan Academy of Agricultural Sciences, Chengdu. Video screening on dry seed nursery raising and broadcasting of rice seedlings. Presentation by Dr Zheng on different crop-establishment techniques of rice. Presentation by Dr Tang Yonglu on wheat-establishment techniques in China Night stay at Wang Jiang Hotel, Chengdu.
26 May, 2000	Friday	Visit Dujiang Dam/Dujiangyan Irrigation Project. Dr S I Bhuiyan and Dr R K Gupta met Dr Niu Dun, Director, Administrative Department of Agricultural Mechanization, Ministry of Agriculture Night stay at Wang Jiang Hotel, Chengdu.
27 May, 2000	Saturday	Leave Chengdu, China Arrive Bangkok Night stay at Ambassador Hotel, Bangkok.
28 May, 2000	Sunday	Leave Bangkok for respective destinations.

Annexure III

List of Experts and Other Officials met in China

Chen Xiao
Professor
Institute of Crop Breeding and Cultivation
Chinese Academy of Agricultural Sciences
30 Baishiqiao Road, Beijing 100081.

Zhu Liang
Assistant Director and Senior Engineer
China Agricultural Machinery Testing Centre (CAMTC)
Shilihe, Dongasanhuan Nanlu
Beijing 100021.

Huang Ming-Zhou
Vice Director and Senior Engineer
Department of Farm Mechanization Management
Ministry of Agriculture
11 Nong Zhan Guan Nan Li, District of Chan Yang
Beijing 100026.

Jiao Gang
Director and Senior Engineer
China Agricultural Machinery Testing Centre (CAMTC)
Shilihe, Dongasanhuan Nanlu
Beijing 100021.

Wang Xin Ying
Vice Chief-Section and Senior Engineer
China Agricultural Machinery Testing Centre (CAMTC)
Shilihe, Dongasanhuan Nanlu
Beijing 100021.

Liu Heng Xin
Senior Engineer and Division Director
China Agricultural Machinery Testing Centre (CAMTC)
Shilihe, Dongasanhuan Nanlu
Beijing 100021.

Niu Dun
Director
Administrative Department of Agricultural Mechanization
Ministry of Agriculture
11 Nongzhanguan Nanli District of Chao Yang, Beijing 100026.

Xu Zhenxing
Vice Director and Senior Engineer
Agricultural Mechanization Technology Development & Extension Centre
Ministry of Agriculture
Nanfangzhuang Jia 60, Chengshousi
Fengtai, Beijing 100078.

Xin Zhiyong
Director and Professor
Institute of Crop Breeding and Cultivation
Chinese Academy of Agricultural Sciences
#30 Baishiqiao Road, Beijing 100081.

Cui Peng Wei
Engineer
Department of Agricultural Mechanization
Ministry of Agriculture
No.11, Nongzhanguan Nanli
Beijing 100026.

Shengxiang Tang
Professor and Liaison Scientist
IRRI-China Office, c/o CAAS, Post Box 68
#30 Baishiqiao Road, Beijing 100081.

Zhongqiu Wang
Adminstrative Coordinator
IRRI-China Office, C/o CAAS
Post Box 68, # 30 Baishiqiao Road,
Beijing 100081.

Zhu Zhonglin
President
Sichuan Academy of Agricultural Sciences
and Vice President
China Society of Plant Nutrition and Fertilizer
No. 20 Jingjusi Road, Chengdu City
Sichuan 610066.

He Wei
Agronomist and Potato Specialist
Crops Institute of Sichuan Academy of
Agricultural Sciences
Chengdu, Sichuan 610066.

Zheng Guo Bin
Chief Reporter
Sichuan Daily
70 Hongxingdu Section 2
Chengdu, Sichuan.

Zheng Jiaguo
Professor
Master of Cultivation Department
Crop Research Institute
Sichuan Academy of Agriculture Sciences,
ShiZiShan, Chengdu, Sichuan 610066.

Huang Gang
Assistant President
Sichuan Academy of Agricultural Sciences
No. 20, Jingjus Street, Chengdu
Sichuan Province 610066.

Han Nanping
Administrative Officer
CIMMYT–China Office
C/o Chinese Academy of Agricultural Sciences
30 Baishiqiao Road
Beijing 100081.

Rice-Wheat Consortium Traveling Seminar Report Series 2

Study of Research and Extension Issues in the Sichuan Province of China for Farm-Level Impact on the Productivity of the Rice-Wheat System

Edited by
R K Gupta, P R Hobbs, M Salim,
N H Chowdhary, and S I Bhuiyan

Facilitation Unit
Rice-Wheat Consortium for the Indo-Gangetic Plains
IARI Campus, Pusa, New Delhi 110 012, India
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Editors

R K Gupta is Regional Facilitator, Rice-Wheat Consortium for the Indo-Gangetic Plains, CIMMYT–India Office, NBPGR (Old) Building, IARI, Pusa Campus, New Delhi 110 012, India.

P R Hobbs is Co-facilitator, Rice-Wheat Consortium for the Indo-Gangetic Plains, New Delhi and Regional Representative, CIMMYT, South Asia Regional Office, P.O. Box 5186, Lazimpat, Katmandu, Nepal.

M Salim, National Coordinator (Rice-Wheat) and Principal Scientific Officer, National Agricultural Research Centre, Park Road, Islamabad 45500, Pakistan.

N H Chowdhary is Acting Director (Research), Bangladesh Rice Research Institute, Joydebpur, Gazipur 1701, Bangladesh.

S I Bhuiyan is Representative, IRRI Bangladesh and Water Scientist, House # 39, Road 23, Banani, Dhaka 1213, Bangladesh.

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The initial support from the Asian Development Bank and the International Fund for Agricultural Development provided the groundwork for establishment of the RWC in 1994 and formalizing the collaborations between the NARS, IARCs and ARIs. The NARS-driven strategic ecoregional research initiatives with financial support from the Governments of the Netherlands, Sweden, Switzerland, Australia and the US Agency for International Development and the World Bank have grown over the years into a dynamic agenda of resource conservation technologies appropriate to different transects of the Indo-Gangetic Plains. The on-going successes in scaling-up resource conservation technologies for enhancing productivity and sustainability of the rice-wheat systems are beginning to create a revolution and favorably benefit large areas and more numbers of farm families.