Rice Wheat

Rice-wheat Information sheet

Issue 47 December 2003

In this issue

Editorial

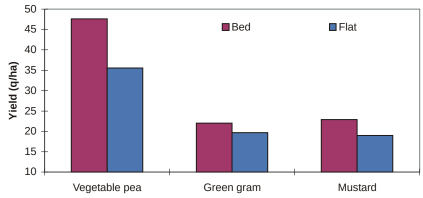
In tropical climates farmers usually till their fields to control weeds and to turn over stubbles and residues of the preceding crops back into soil. South Asian farmers had a long tradition of incorporating crop residues into soil and green manuring their fields to build soil fertility and to control weeds Not long ago, farmers used to apply farmyard manure (FYM) to fields on an average 4-5 year rotation. This practice is now increasingly getting into dis-use and its rotational period has increased to 10-12 years. This has led to its over all situation wherein soil organic carbon (SOC) stocks have declined in different regions. The decline in SOC is reported to be more in rice wheat systems. In South Asia, acreage of zero-till wheat is spreading rapidly and efforts are being made to extend some of the agronomic practices of wheat to rice culture such as to avoid puddling and rice transplanting, save on irrigation water, and develop a permanent system of 'no-till agriculture' on flats or on the raised beds. How to manage crop residues in no-till rice and wheat crops with contrasting edaphic requirements is still a major problem, yet to be resolved.

Rainfed farming communities are aware of the virtues of crop residue mulches but lack of appropriate equipments to plant into loose residues has been a major bottleneck in surface retention of straws. As a consequence, farmers manage them either by incorporation into soil using a disc harrow, remove them or burn them partially or completely. Partial burning of loose rice straws facilitates planting of wheat with zero-till drills but pollutes the environment adding to green house gases. Therefore, researchers are busy in redesigning the locally available zero-till machines to enable farmers to seed into loose residues. This RWIS contains new innovations in machinery design for seeding into loose residues. For effecting a shift wherein both rice and wheat crops could be planted in no-till fields in presence of residues of rice crop, efforts are needed to ward-off any threat from the changing dynamics of predator/parasite and pest balance under continental monsoonal type climates. Education of farmers on various aspects of disease and pest control will make the task easier to change over from conventional till to no-till agriculture with residues.

In this issue of the Rice-Wheat Information Sheet (RWIS), an attempt has been made to report new findings within a very flexible format. Although RWIS has come a long way, but is still in formative stages and would need help from all the consortium partners to serve as an effective instrument for disseminating new information.

Bed Planting: A Technique for Higher Oilseed and Pulse Production

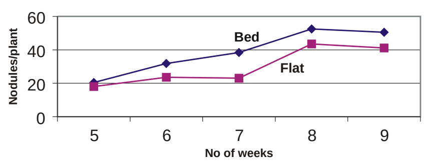
In the era of globalization and open general licensing (OGL) policy , it is of immense importance to reduce the cost of production through use of innovative technologies and make national agriculture competitive in the world market. In this endeavour, bed planting, a new planting technique modified at DWR, Karnal on the pattern of CIMMYT, Mexico, has shown encouraging results for diversification of rice-wheat system. In bed (70 cm from furrow to furrow), two to three rows of wheat are grown on top of bed and irrigation is applied in furrows whereas in conventional planting wheat is grown at 20 cm apart under flat condition. This resource conservation technology saves ~ 25% seed and N and 15-40% water depending upon the soil type and helps control especially *Phalaris minor* weed in wheat. Susceptibility of oilseed and pulses to water logging under flat planting with flood irrigation is one of the major causes of their low productivity in Indo-Gangetic plains with continental monsoonal climates. Bed planting provides a window for many crops like pigeon pea, vegetable pea, green gram, soybean and Indian-mustard to maximize the system productivity. Additionally, once the beds are formed in rice season they can be used without any preparatory tillage for the succeeding wheat crop, which will save fuel, time, and energy and most importantly will provide eco-friendly cultivation by reducing CO_2 emission due to lesser diesel consumption.



Performance of oilseed and pulses under different planting methods

Bed planting promotes diversification of R-W systems

Three crops namely green gram (Var: Narendra 1), vegetable pea (Var: Arkel) and mustard (Var: Agrani) were grown on flat and raised beds as per recommended practices. These crops were grown in two rotations namely rice-vegetable pea-wheat and rice-mustard-green gram. It was observed that bed planting exhibited higher yield as compared to flat planting. Vegetable pea



Nodule numbers in green gram under different planting systems (as a green pod), mustard and green gram recorded up to 34.0, 20.4 and 11.8 % higher yield as compared to flat planting, respectively. This showed that bed planting could be used for diversification/intensification of rice-wheat system.

Green gram was planted on flat and bed at equal spacing. Ten plants were uprooted gently, washed and their nodules were counted. Root dry weight was also recorded. It was observed that green gram grown after wheat on beds, just by reshaping, recorded higher nodule number per plant as well as higher root dry weight than conventional till flat planting. Thus, this lead to higher gram yield in bed planting as compared to the flat planting system.

S.C. Tripathi, A.D. Mongia and Jag Shoran
Directorate of Wheat Research, Post Bag 158, Karnal, India
(Email:tripathisc@yahoo.com)

II World Congress on Conservation Agriculture: Salient Aspects

The II World Congress on Conservation Agriculture (WCCA2) is now over. There are many reasons why the Congress was such a success with more than 900 participants representing about 50 countries.

I would like to highlight the remarkable advances made in the two years which succeeded it, both in area adopted (now totalling 72 million ha of annual crops worldwide - an additional 7 million ha since 2001(date of the I World Congress in Madrid) - and at least a similar area of agro forestry/perennial crops) and the evolution of Conservation Agriculture (CA) technology and its implementation in many new farming systems in the 50 countries represented in the WCCA2. The field tour was very stimulating, particularly to see the lead taken by farmers to develop CA. Typical of Brazil and its people! Apart from the papers/posters, the creation of new contacts was probably the most important consequence. At the congress I learnt a great deal from a wide range of paper and information presented to demonstrate, that CA is applicable to all crops, soils and environmental situations. This encompasses a wide range of agro-ecological zones, from north to south and lowland to hilly lands and highlands; farm sizes and cropping systems, from subsistence, hand-hoe based small farms to large, broad acre fully mechanized farms in Australia and USA; and both rainfed and irrigated. CA is never "forced" on the farming community. Rather, there are now many examples of farmer-led initiatives to implement CA across large areas fully supported by both local research Institutes and farmer-led and organized support groups. Many advances have been made in technological options suited to the needs of small, medium and large scale farmers.

I believe that the ideas of some of the participants were truly affected after seeing the most impressive agricultural innovations which are taking place in Brazil. Especially, that CA is anything but a narrow concept. If by pre-chosen elements it is meant the four basic principles of CA - then these have been meaningfully simplified to give a focus for CA. However, they are only a simple "front page" for one of the widest set of farm-practicable concepts and practices in any agriculture system. Vital to CA is that it does not focus on the symptoms or effects (i.e. as done by terraces (contour banks) set up to control water running-off due to less than best land management practices). Rather it focuses on a wide array of causes and aims to provide on-farm, practicable and fully research supported solutions to these problems. As an example, CA improves the soil structure and enhances the soil organic status - that in turn fully improves the soil water infiltration, leading greatly reduced erosion - hence need for water control and the (expensive) building and maintenance of physical farm structures, like terraces/contour banks. This site-specific physical structures may be needed in certain cases just a back up.

Jose R. Benites
FAO - B709 Viale delle Terme di Caracalla – 00100, Rome, Italy (Email: Jose.Benites@fao.org)

Seed Rate in Direct Seeded Rice

Rice is generally grown as a puddled transplanted crop in northwest of Indo-Gangetic plains to reduce water percolation losses and weed infestation. Paucity of labour in peak rice transplanting season, increasing transplanting and puddling costs and inadequate population planted per unit area by hired labour has necessitated the search for alternative methods for establishing rice crop. Direct seeding of rice is one such option wherein rice seed can be seeded directly into moist soil using drills or else pre-soaked, pre-germinated seed is broadcasted into puddled soils. Direct seeded rice has the advantages of faster and easier planting, less labour and drudgery and earlier crop maturity by more than 10 days compared to transplanted rice. The major concerns for direct seeded rice include depth of seed placement, soil moisture in seeding zone, weed management, soil crusting due to pre-monsoon showers, and iron chlorosis. To overcome some of these problems and establish good plant stand in direct seeded rice, seed rate as high as 100 kg/ha has often been recommended (Technical Programme, All India Agronomy Coordinated Trials, 2002-2003, DRR, Hyderabad). For plant spacing of 20×15 cm, it requires around 0.33×10^6 plants per hectares (nearly 10 kg seed/ha). Higher seed rate/plant population not only causes N deficiency, greater disease and pest incidences but the crop become more prone to lodging.

Seed rate and yield

A field trial on direct seeded rice was conducted with different seed rates varying from 30 to 80 kg/ha during 2002. We observed similar yield at varying seed rates, suggesting that the seed costs can be further reduced. In 2003 rice season, an additional treatment of 20 kg/ha was added to the original trial initiated in 2002. The varying seed rates were kept based on earlier recommendation of the Directorate of Rice Research of 80-100 kg/ha, which seemed too high. The variety used was IR 64 having a 1000 grain weight of about 26 grams. For a population of about 0.33×10^6 plants/ha recommended for transplanted rice, the seed requirement is likely to be around 11 kg/ha after giving an allowance of 20 percent loss in germination percentage of seed. If rodent and bird damage are further added to the estimates, almost double the seed requirement (20 kg/ha) should be good enough. The trial was sown in the first week of July during 2002 and second week during 2003 when the transplanting is generally done. The yield recorded was almost similar at seed rates of 20 to 80 kg/ha (Table-1). The crop matured about 15 days after the transplanted rice and was harvested in the last week of October.

Table 1. Influence of seed rate on yield and stem borer damage in direct seeded rice

Seed rate kg/ha	Grain yield (q/ha)		Stem borer damage (dead hearts/sq.m.)	
	2002	2003	2002	2003
20	-	66.52	-	3.3
30	73.91	68.51	2.0	3.9
40	76.85	67.07	2.6	4.9
50	72.44	68.79	1.6	4.7
60	72.65	69.05	3.6	4.3
70	74.96	68.95	3.4	6.5
80	74.96	65.41	3.6	6.0

Seed rate and insect-pest

It was observed that the insect pest incidence was influenced by the seed rate especially in the case of stem borer, leaf folder etc. The data presented here (Table 1) shows that with the increase in seed rate the incidence of stem borer increased. This may be due to higher than optimum density of the crop stand. The study suggests that there is a need for further systematic investigations on this aspect and also there is no documented evidence on seed rate and pest incidence in the country. Moreover, the recommended seed rate of 80-100 kg/ha is too high and needs to be reduced substantially.

Managing weeds in direct seeded rice

Weeds are a major problem in direct seeded rice. Selection of genotypes with high yield potential as well as vigorous growth can help in managing weeds. The ideal plant type that can strongly compete against weeds has shoots that spreads and cover the ground rapidly during the vegetative stage.

The success of direct seeded rice will depend on the proper time of sowing, uniform plant population, suitable weed control measures and use of high-yielding cultivars with lodging resistance.

For wet direct seeded rice, sofit @ 1500 ml/ha applied within 4 days of seeding was found effective against weeds. This herbicide requires standing water for efficient control of weeds. Some of the post-emergent herbicides like Fenoxaprop has shown good results against grassy weeds. For the control of broadleaf weeds 2,4-D, metsulfuron or ethoxysulfuron can be used. Ethoxysulfuron has shown good compatibility with fenoxaprop.

Delayed seeding reduced weed infestation also because the weeds germinate by the beginning of July and are killed during tillage and puddling. The direct seeding in the month of July has an additional advantage of less water requirement as it coincides with the arrival of south west monsoon in this zone. In addition the labour involved for raising nursery and then transplanting is also saved.

R.K. Sharma, R.S. Chhokar and K.S. Babu
Directorate of Wheat Research, Karnal 132 001

Writers' Place

Farmers' Experimentation in Rice-Wheat Based Agro-Ecosystem

Farmers, themselves are the experimenters and innovators of many technologies (Richards, 1985). The small and big innovations make them professional specialists in surviving the vagaries of nature. Yet their skills and knowledge about how land and water resources respond to specific agronomic and crop management interventions are not fully appreciated and recognized by researchers (Chambers, 1989). To assess how resource-poor farmers integrate their knowledge in crop production and manage natural resources and risks, a study was carried out in rice-wheat ecosystem in Sonapur village cluster of Azamgarh district of eastern Uttar Pradesh, India. To detail out farmers' experimentation in cropping systems under changing techno-socio-economic conditions an agro-ecosystem analysis of natural resources and their interactions with society was carried with help from well-informed and creative farmers having small size of land holdings.

Farmer's experimentation in cropping system

Before 1980's Azamgarh farmers had a stable practice of growing red gram + maize + sorghum-sugarcane and wheat in rice-wheat based agro-ecosystem. But gradually, productivity of this mixed cropping system went down. Erratic rainfall, stray cattle and menace of blue bulls (antelopes), drainage congestions caused due to construction of new roads by the village council, incidence of wilt, disintegration of joint family system and lack of government initiative acted in unison to suppress this viable cropping systems (Janaiah and Hossain, 2003). Some moderately resource-endowed innovative farmers took up the challenge of adjusting and creating new cropping systems which were economically viable, more feasible and compatible to socio-economic and biophysical conditions. Farmers evolved three major crop models:

- Black gram + sorghum (summer)-rice (early)-pea and sugarcane for loam (Domat) soils having irrigation facility and gentle slope. This cropping system helps to solve problems of pulse, fodders, enriching soil health, diversification to reduce risk and increasing profitability.
- Green gram+ sorghum + okra (summer)-paddy(early)-potato for medium textured, gently sloppy, irrigated conditions.. In this system farmers have a net earning of US$ 175 -250/ hectare . from within 3 months Okra crop and green gram. With little external inputs and organics (obtained from paddy straw, sorghum, sugarcane leaves etc.), this cropping system is preferred after harvest of potato crop.
- Bodo (cowpea)+maize cobs +okra (summer)-paddy is taken under irrigated condition in medium textured Domat soils. This cropping system is more remunerative as farmers have a net profit of US $ 425-475 per hectare per year.

In new cropping systems farmers are more cautious in the use of crop selection criteria on the basis of cost of cultivation, soil types and slope, household and animals need, green manuring, economy and eco-systems sustainability. These cropping systems are diffusing to similar situations through informal farmers' led extension.

Farmers' Experimentation in Nutrient Management and Tillage Operations

Instead of using more complex packages to cope up particular problem, farmers just try to adjust the timing and crop sequences and make best use of residual values of fertilizer nutrients to get good yield and save the natural resources (Gupta, et al. 2003). In rice based system farmers take potato and then switch over to sugarcane for 2-3 years. After potato harvest in first week of February, many farmers make use of residual soil fertility and save on land preparation costs by planting sugarcane. This enables them to have good germination and growth of sugarcane. For planting sugarcane, farmers simply make a furrow with a local implement to put cane sets directly in the soil. By adopting this method, farmers save about US$ 175 to 250 per hectare and improve cane productivity by 30-40 per cent in comparison to the non-users of this practice. The reported indigenous practices of sugarcane crop are low -cost and compatible to past experiences, economically viable, conserve natural resources, eco-friendly in nature and in tune with local resources availability. In rice wheat system cropping system, zero-till technology introduced very recently in the eastern Gangetic plains by the state agricultural university together with the consortium is also becoming very popular both in rice and wheat crops. Traditionally, farmers had been growing direct seeded rice which was abandoned in favour of puddled transplanted rice. The practice of stale rice beds and 'laeving' (wet planking in submerged germinated rice fields with animal power) may find new favour with the introduction of zero till drills in the area for direct seeding of rice.

Farmers' Experimentation on Crop Diversification and Risk Management

Resource- poor farmers in the area are usually afraid to grow sole crops for the fear of natural vagaries. Consequently they opt for crop diversification either in mixed or intercropping systems. In crop diversification the general intent is to reduce risks of drought and flood prone agriculture and increase profit per unit land and time (Gupta et al, 2003). The prominent intercropping system prevalent with sugarcane growers in the rice-wheat systems includes:

- Sugarcane+onion, cane and onion are planted in February, onion crop is harvested June (first week). Farmers earn about Rs. US$ 800-1100 per hectare besides reduced insect-pest load in the sugarcane.
- Sugarcane+ urd-bean (black gram), planted in February. Bean pods are harvested during April-May and urd-bean incorporated in soil in June July.
- Sugarcane + okra practiced by few farmers.
- Sugarcane + red gram and sugarcane with cucurbits is practiced for home consumption of vegetables. Few small farmers have been observed to take the urdbean with okra and pearl-millet for more monitory gains. The practice is more popular in areas where early paddy is to be taken and farmers are not able to apply more chemical fertilizers.

The study brings out that farmers generally acquire knowledge of cropping systems and natural resource management through experiential wisdom and learning by seeing. This location specific knowledge base is usually more compatible with their biophysical and socio-economic conditions. Integration of farmers' knowledge on local cropping systems into modern crop production practices can significantly accelerate the pace of adoption of newer agricultural technologies. Participatory research and extension approach help not only in validating farmers' experimentation but speedy adoption of the new technologies such as zero till wheat.

Ranjay K. Singh
Deptt. Of Extension Education and Rural Sociology, Central Agricultural, University, Arunachal Pradesh, India
(Email; ranjay_jbp@rediffmail.com)

Small farmer's experimentation with tillage methods in Bihar

Mechanization of Agriculture for Promotion of RCTs in Pakistan

Increasing costs of modern agricultural implements seems to be proving as one of the major hurdles in achieving higher productivity in farming sector. This has kept many a farmer tied to old practices or forced them to stick to machinery that has been replaced by more modern and productive technology in analogous conditions similar to those prevailing in Pakistan. For example , it has been a long haul before Pakistani farmers started using tractors, because of the huge investments involved in the purchase of tractors. Many small and middle level growers could not afford to purchase tractors.

Indegenously developed zero-till machine

Banking facilities enabled relatively affluent farmers to use mechanized methods but marginal improvement in produce did not reflect in any improvement in their lives. In any case, there was no leap of progress. Unfortunately, the industrial base was oriented to high profit and did not play its due role in the development of Pakistan's agriculture. Growth in the agriculture sector has remained extremely limited while pressures on the sector mounted because of population growth and high cost of food imports. Admittedly, lack of affordable equipment has undeniably been a major handicap of Pakistan's agriculture.

New developments in farm sector are however encouraging. A number of small entrepreneurs have come forward to produce latest farm implements at a cost that are within the reach of many farmers. The fear is that majority of small farmers with very small-holdings would still be left behind. Therefore, this limitation needs to be removed. Resource conservation technologies have been adopted by many countries across the world in the past few years. Pakistan has also embarked on this path but the pace has been slow due to expensive machinery used. However, some local entrepreneurs have indigenized the manufacturing of zero-till drills and have brought down the prices considerably in the process. Zero-tillage technology (ZTT) was transferred to Pakistan in 1980 through CIMMYT, Mexico, one of the sixteen Future Harvest Centers of the Consultative Group of International Agricultural Research (CGIAR) of the World Bank. CIMMYT also spearheaded the Green Revolution in wheat during 60's. The USAID and Massey University of New Zealand also helped Pakistan obtain this technology. At that time, the cost of a ZT drill was Rs3,60,000; the price has been brought down to Rs30,000 per drill by local manufacturers by now. A three-year period-1981-84- was spent in local fabrication and another six years were invested in pilot testing of locally fabricated implement. During demonstration phase (1996-99) farmers became aware of zero-till machines. Since 2000, the drill has been adopted on a wide scale. Although zero-till drill can be used to plant several crops, but is primarily used for planting of wheat crop in Pakistan. ZTT allows early sowing by five days to two weeks, saves about 20 per cent irrigation water, reduces cost of cultivation by almost Rs 1000/ acre, increases plant population by at least 20 per cent and improves wheat yields by 33 per cent. Fuel consumption in ZTT reduces by 25 per cent. The technology importantly, improves soil fertility.

The Federal Ministry of Food and Agriculture through NARC, PARC, and Directorate of On-Farm Water Management (OFWM) , Punjab Government together with CIMMYT and the Rice Wheat Consortium (RWC), have played a pivotal role in propagation of this technology to benefit the farming communities in Pakistan. Unfortunately, Punjab government did not attach a higher priority and gave as much support to the ZTT as it deserved. Other provinces totally neglected it.

Raised bed furrow irrigation system (Bed Planting system) saves irrigation water, improves productivity and promotes crop diversification. Local manufacturing of the bed planters has brought down the price of the machine from Rs150,000 to Rs30,000 in seven years (1996-2003) in spite of inflating trends in raw material prices. These two implements have been brought within the reach of most farmers. Laser assisted precision land leveling technology is a precursor technology for all crop production operations. The laser land leveling system is still quite expensive. The laser land leveling equipment used to cost one-million rupees in 1985 but now costs only Rs 0.325 million. Farmers with large land holdings or those interested in custom services or agri-business can only afford it. Actually, the small landowners may find even ZT and BP beyond their resources. Punjab government has plans for making these implements available at Union Council level so that most of the farmers could benefit from them. The intentions sound very good but how well and how soon these plans turn in to actions is still a big question mark. There is no time to be wasted as the country needs: speedy mechanization of the farming sector and adoption of latest technologies. This is essential for not only meeting increasing food needs but also for meeting challenges of new WTO regimes.

Zafar Samdani

The Happy Seeder Concept - A Solution to the Problem of Sowing into Heavy Stubble Residues

The burning of rice stubble to aid in the seedbed preparation for the subsequent crop causes two major environmental problems. Firstly atmospheric pollution in the rice growing areas of the world can be horrendous and threaten human health. Secondly the reduction in soil organic matter, due to burning, is a threat to long-term soil health. In line with the environmentalists concern for a more natural system, it would seem prudent to revert as far as possible to a mulch system of farming. Nature, in spite of millions of years of evolution, has never come up with any sort of mechanical plough. Other than biomass generation in the root system of plants, and some detritus accumulation in soil cracks, all natural organic incorporation into soil is by macro- and micro-organisms (nature's ploughs) biologically incorporating surface litter. Surface mulching reduces direct soil evaporation.

The Problem

Mechanical incorporation of residue consumes extra fuel, increases machinery wear and tear and adds to the farms labour bill. Burning of the residue, a common practice in many rice/wheat-producing areas of the globe to prepare land for the following crop, constitutes an environmental and health risk of monumental proportions. By using surface mulch techniques we can remove this environmental hazard, conserve water, reduce fuel consumption and improve timeliness. All of these should improve net farm income and farmer and community wellbeing. Direct seeding without incorporation or burning of residue is the solution. However, no 'Zero Till' seeder known to the authors is capable of sowing direct into a heavy, mechanically harvested, rice straw crop.

A Solution

The "Happy Seeder" approach enables direct drilling into heavy stubble and trash in wet or dry conditions, by simultaneously removing the stubble/trash, direct drilling into bare soil, and redepositing the material as a mulch on the sown area. The approach simply combines the attributes of two machines; the forage harvester and any direct till drill. The forage harvester cuts, chops and lifts the straw, presenting to the drill a "bare" soil surface suitable for direct drilling. The chopped material is dropped directly behind the drill as mulch on the seedbed. (Figure 1).

Figure 1. The chopped material is dropped directly behind the drill as mulch on the seedbed.

The "Happy Seeder" technique obviates the need for burning, reducing both particulate and greenhouse gas air pollution. The technique reduces the need for weed/trash control measures prior to sowing, reducing fuel consumption compared to normal tillage. The "Happy Seeder" is able to sow a field immediately the harvester has passed, thus providing an option for timely sowing and using soil moisture before it evaporates. It saves many passes with tillage implements, a common practice on the subcontinent, even after burning of stubble. The "Happy Seeder" can sow on beds or the flat simply by changing the drill type and allows residue retention until the point of sowing, followed immediately by mulching. This reduces the risk of wind and water erosion, improves soil organic matter content, structure and infiltration, and reduces evaporation from the soil surface, thus potentially improving water use efficiency. The mulch also suppresses weeds and reduces heat loss at night. Traditionally one irrigation is applied to the rice stubble field to enhance stubble decomposition and ease the passage of the drill. This irrigation is not required with the "Happy Seeder" as the sowing can be done on antecedent moisture from the rice crop thus improving the overall water use efficiency of the farming system.

The first year agronomic results from a simple replicated trial on beds, with sub-optimal fertilizer management, were encouraging. The wheat variety PBW 343 was sown on 28/10/2002 at 87.5 kg/ha into standing rice stubble (~5 t/ha), with no fertilizer at sowing as it was a spur of the moment opportunistic sowing. The rice straw residues were then redistributed to achieve three mulching rates of 0, 4, and 8 t/ha. Urea at 60 kg N/ha was topdressed on the bed/mulch surface before the first and second irrigations (total 120 kg N/ha). Establishment, yield and yield components were similar in all treatments (Table 1, Figure 2).

Rice straw residues remaining post wheat harvest were 0.0, 2.7, and 3.7 t/ha respectively for the 0, 4.0, and 8.0 t/ha treatments. This straw was well weathered and broken down and posed no problem for direct drilling of rice on beds the following season

Good establishment and a uniform crop were also achieved for wheat sown on the flat into about 6.5 t/ha of standing rice stubble on 28/10/2002, with the loose straw spread uniformly. More extensive field trials in the 2003 wheat season are also showing similar establishment in the stubble removed and stubble retained treatments.

Table 1. Establishment, yield and yield components of 2002 "Happy Seeder" bed sowing trial

Rice straw (t/ha)	Establishment Plants/m^2	Tillers per m^2	Ears per m^2	Grains per ear	Average grain weight (gm)	Straw yield (t/ha)	Grain yield (t/ha)	Weed matter (t/ha)
0.0	146	257	240	52	41.05	7.18	3.83	1.32
4.0	138	268	253	41	43.15	6.49	3.78	0.98
8.0	138	262	247	44	45.55	6.19	3.44	1.12
CD (5%)	NS	NS	NS	NS	NS	NS	NS	NS

Figure 2. wheat emergence through ~6.5 t ha^{-1} rice straw on the flat 2002.

Conclusion

The "Happy Seeder" approach to stubble management has proved to be an efficacious method of dealing with rice residues in the Indo-Gangetic plain. Further extensive field trials are required to encourage broader uptake of the idea by the farming community, however the concept has been widely recognised by the rice/wheat research community as having potential. A number of groups are developing their own Happy-like seeders, which bodes well for rapid uptake as further results come to hand.

John Blackwell, Harminder Singh Sidhu[2], S.S. Dhillon and Anil Prashar
CSIRO Land & Water, PMB 3 Griffith NSW 2680, Australia, and PAU Ludhiana, Punjab, India (Contact Email: John.Blackwell@csiro.au)

Role of Soil Colloids in Carbon Accumulation in Soils: A View

Soil organic matter pool, based on carbon dynamics can be divided into four categories.

- *Active or labile pool* is composed of readily oxidized compounds and depends largely on plant residue inputs and climate. This pool is apparently not influenced by soil mineralogy and usually constitutes 2-5% of soil organic matter content.
- *Moderately oxidized pool* is associated with soil microaggregates. Its dynamics and pool size are affected by soil properties and mineralogy. This pool is usually 18-40% of total organic matter (OM). Since soil mineralogy has a major role in storing OM in m*oderately oxidized* pool, a minimum value of 18% of total OM could be attributed to soil mineralogy.
- *Slowly oxidized pool* associated with micro-aggregates, is mainly controlled by water stability of the aggregates. Agronomic practices have only little effect on the size of this pool. Since water stability of aggregates is determined by exchangeable cations (mostly Ca, Mg and Na) and nature soil mineral colloids, slowly oxidized pool is indirectly influenced by mineral make-up of soils. The relative proportion of this pool varies from 20-35% of the total OM. Even on conservative estimates, it seems that about 20% of total OM in *Slowly oxidized pool* is controlled by soil mineralogy.
- *Passive or recalcitrant pool* consists of OM, sequestered physically and or chemically. This pool is mainly controlled by soil mineralogy and agronomic practices probably have no effect on the pool size. The relative proportion of total OM physically and chemically sequestered is 20-40% and 20-40%, respectively (Batjes, 2001). Here also if the minimum values are accepted we find that 20% physically and another 20% chemically sequestered OM will be controlled by soil mineralogy.

The total proportion of OM which will be controlled by soil mineralogy is thus calculated as (a) moderately oxidized pool: 18%; (b) slowly oxidized pool: 20%; (c) passive pool (i) physically sequestered:20%; and (ii) chemically sequestered: 20%. Thus, it appears that perhaps a minimum 78% of the total OM in soil is controlled by inorganic substrate (precisely phyllosilicate minerals with higher surface area in the finer fractions). Any endeavor for improving soil health and productivity, soil mineralogy thus assumes a special importance. The long-term manurial experiments (9 years) carried out at Faizabad soils (Rice-Wheat) (Kumar and Yadav, 2003), sodic soils of Zarifa Viran (Rice- Wheat) (7 years) (Swarup, 1998), alluvial soils (maize-wheat) (15 years) (Biswas et al, 1971) dominated by micaceous minerals, show an increase of OM from 0.40 to 1.0%, 0.40 to 0.63% and 0.9 to 4.2% respectively due to interactions of agronomic and nutrient management practices.

T. Bhattacharyya & D.K. Pal
NBSS & LUP, Nagpur, India
Email:(tapas@nbsslup.mah.nic.in; tapas11156@yahoo.com)

Weed Management in Zero-till Direct Seeded Rice: Some Promising Developments

Weed management in direct seeded (DSR) and transplanted rice both on the flat and the raised beds will involve an integration of several modifications in crop management. Zero till on the flat and/or permanent beds reduces soil movement by tillage to a minimum. Non-stirring up the seed bank leads to a rapid reduction in their population over time in many weed species. To exhaust the seed bank near the soil surface, it requires that we combine the zero-till with sound weed control management practices from the beginning not to allow replenishment of the seed bank from current season weeds. Surely, if the practice of zero till or permanent beds is combined with surface retention of crop residues, the weed populations can be further reduced. Finally, rice cultivars that are well adapted to new planting systems and which have good weed competing characteristics based on morphology and perhaps involving alleopathic differences will be needed. For tackling weed management issues in direct seeded rice, there are tremendous opportunities to work with rice breeders to identify rice cultivars that are less affected by seeding depth, iron and zinc deficiencies when seeded into tilled or untilled unpuddled soils without continuous flooding. But given all of these options to include, we will still need to have an understanding to fall back on rational herbicide use as and when needed. Results of field trials given in Table (1) clearly suggest that once the weed management issues of DSR are resolved to farmers' satisfaction, rice could be grown using some of the resource conserving technologies evolved for wheat.

This short report shares our field experiences on dynamics of weed flora and effects of different herbicides and cultural practices in direct sown rice or transplanted rice under flat zero till and permanent raised bed systems in comparison with conventionally puddled transplanted rice. Some of our field observations are summarized as under:

Table 1. Grain yield and water saving in different crop establishment techniques

Crop establishment technique	Grain yield (t ha^{-1})		Water saving (%)	
	2002	2003	2002	2003
Conventional puddled transplanted rice	7.27	7.23	-	-
Zero-till DSR (Early Sown)	7.26	6.60	19	21*
Zero-till DSR (Late Sown)	6.34	5.62	18	23

*Saving referenced to use of irrigation water in conventional puddled transplanted rice .

- Yield loss due to weeds in DSR was 88 % compared 57 % in conventional puddled transplanted rice (weedy checks).
- Density and dry weight of weeds were 80 to 237 % higher in ZT-DSR compared to conventional transplanted rice. Weed populations were higher in direct seeded rice on raised beds.
- Although weed flora varied with location in tune with agronomic and crop management practices, the relative proportions of grassy and broadleaf weeds and sedges were 6, 4 and 4, respectively in conventional puddled transplanted rice. In ZT-DSR, the proportion of grassy, broadleaf weeds and sedges was 13, 19 and 4.

Effect of herbicides

Grassy weeds

For control of grassy weeds in DSR, several pre-emergence, early post-emergence and post-emergence herbicides can be used as under:

- Pre-emergence application: Pendimethalin (Stomp 30 EC), @ 1000 g ha^{-1}, pretilachlor (Sofit 30 EC) with safner @ 500 g ha^{-1},
- Early post-emergence application: Propanil (Machete Starter 35 EC) @ 1750 g ha^{-1}, cyhalofop butyl (Clincher 10 EC) @ 120 g ha^{-1},
- Post-emergence applications: Fenoxaprop (Whip Super 9.9 EC) @ 50 g ha^{-1} .

Sesbania as green manure crop for puddled transplanted rice need additional irrigation water (a). Sesbania and direct seeded rice can be seeded simultaneously to save water, provide organics and manage weeds (b). After 25-30 days, Sesbania can be killed using herbicide, 2,4-D (c), for a healthy crop (d).

Following precautions may be taken in using the above herbicides:

- Pendimethalin: It is better to spray the chemical within 2-3 days after seeding.
- Pretilachlor with safner: Requires stagnation of water for few days for its efficacy, which is not desirable for proper germination of rice seeds. If we wait for the germination of rice seeds, in the mean time, weeds also germinate. Therefore, seed priming is a must which helps in early germination of rice than weeds.
- Cyhalofop butyl: is a foliage applied herbicide and controls only *Echinocloa colona* and not the other grassy weeds if applied at early growth stage of the weed.
- Propanil, fenoxaprop: are also foliage applied herbicides, weeds keep on germinating even after spays in DSR.

Broad leaf weeds and sedges:

For early post-emergence applications use:

- Chlorimuron + metsulfuron mixture (Almix 20 WP)@ 4 g ha^{-1} ; ethoxysulfuron (Sunrise 15 WDG), @ 18 g ha^{-1} or bensulfuron (Londax) @ 60 g ha^{-1}
- post-emergence application 2,4-D at 500 g ha^{-1} or trichlopyr control the broad leaf weeds effectively in DSR.
- No herbicides completely kill the sedges, but the above broadleaf herbicides suppress the sedges except *Cyprus rotundus* to some extent.
- Tank mixture of propanil + trichlopyr is found effective against *Cyperus iria*, *Cyeprus deformis* and *Fimbristyllis spp*.

Broad-spectrum weeds:

- Spray of pre-seeding herbicides such as gramoxone and glyphosate at 5% kill all germinated weeds. Clearing the main fields before planting zero-till DSR or zero till-transplanted rice is one way of keeping the fields clear of weeds before the establishment of rice crop.

- For control of all type of weeds in one application, antagonistic effects were observed when cyhalofop butyl in tank mixture with almix and 2,4-D were used. It is better to apply them in sequential application.
- Tank mixture of fenoxaprop with ethoxysulfuron has synergistic effect on weeds.
- The 2x dose of all the herbicides except cyhalofop butyl caused some phytotoxic effect on young rice seedlings; hence, recommended dose with proper spray techniques should be used at appropriate time.

Cultural Practices in DSR for Effective Weed Management

- Stale bed technique is an effective tool to decrease seed bank of weeds.
- After emergence of rice seedlings, initial flooding for two weeks reduces the weed infestation to a great extent. However germination of barnyard grass occurs even in standing water of 3-5 cm.
- Mulching not only reduces weed infestation up to 40%, but also conserves the moisture and improves the overall soil health resulting in good crop yield (Table-2).
- Growing of sesbania as an intercrop with DSR up to 30 DAS reduces the weed infestation by 30%. Keeping the sesbania+ rice although initially reduced tillering but once Sesbania is killed with 2,4-D or trichlopyr, promoted tillering , plant growth and yield (Table 2). This practice adds organics without additional need for irrigation water.

In our experiments, grain yield in ZT-DSR (with mulch and/or sesbania) was slightly inferior to puddled transplanted rice despite lower weed populations (by ~30%) and nearly 20% saving in water. Shading of rice seedlings by sesbania seems to be main reason for little lower yields.

These filler trials suggest that with adjustment in planting timing, choices for rice cultivar and type of GM crop it is possible to grow green manure with direct seeded rice without additional need for water. Results of the experiments conducted at PDCSR, Modipuram (RS Mehla, 2003, Personal Communication) suggest that this slight loss in rice productivity is compensated by increased wheat yields, implying no loss in system productivity. .

As an alternative to direct dry seeded rice (DSR) with herbicide usage, stale bed technique has been evaluated in farmer participatory mode on several hundred acres in Uttranchal by Dr. Govindra Singh of GB Pant Univ. of Agric. & Technology, Pantnagar. In these trials stale bed technique for effective weed control was evaluated using direct dry seeding (unpuddled soils), wet seeding (puddled) and conventional puddled transplanted rice. Results of the trials given in Table 3 clearly suggest that puddling which deteriorates soil structure can be avoided through DSR stale bed technique. Hundreds of farmer participatory trials bring out that with development of good weed management practices, yields of DSR could be at par or even better that conventional puddled transplanted rice.

Table: 2 Effects of crop establishment techniques on weed and grain yield (Mg ha^{-1}).

Weed control treatments	ZT-DSR without mulch & sesbania	ZT-DSR with mulch	ZT-DSR with sesbania	Conventional transplanted rice*
Weed Free (Manual)	4.95	5.86	5.36	5.89
Herbicides fb Hand Weeding	4.58	5.31	5.08	5.80

* yields adjusted to same seeding days

Table 3. Average performance of DSR, WSR and puddled transplanted rice

Items of costs	Dry seeded rice	Wet[1] seeded rice	Puddled transplanted
Total variable costs	3851	4948	7876
Fixed costs (labor, fertilizers, irrigation, pesticides)	8400	8400	8400
Grain yield, Mg ha^{-1}	6.69	6.76	6.14
Net returns	23206	23480	16266

DSR: direct drilling in unpuddled soils with stale bed technique and Pendimethalin @1kg ai with in 2-3 days using 500-600L water

[1]Wet seeded rice: Pre-germinated seeds in puddled soil and use of Anilofos @400g ai in 500l water at 2 leaf stage

Source: Govindra Singh, Rice Bulletin -135, Directorate of Experiment Station, GBPUA&T, Pantnagar, Uttranchal, Oct. 2003.

Samar Singh[1], Lav Bhushan[1], J.K. Ladha[2], Raj Gupta[1], R.K. Naresh and P.P. Singh

[1]RWC/ CIMMYT-India, Pusa New Delhi and [2]IRRI, Los Banos, Manila, Philippines

Potential of RCTs in Eastern Gangetic Flood Plain: A Remote Sensing Analysis

Problems of improving agriculture in Eastern Gangetic flood plains are complex due to uncertainty and risks associated with the onset and recession of floods spatially and temporally. This often results in complete failure of summer and *kharif* crops and delays sowing of *rabi* (winter season) crops. Late planting not only reduces yield but also affects input use efficiency. Resource conserving technologies (RCTs) provide options for timely planting of crops. Satellite Remote Sensing techniques have proved to be a potential tool for monitoring and mapping spatial-temporal dynamics of floods and opportunities for accelerated, repetitive and synoptic resource surveys in different windows of the electromagnetic spectrum from its vantage point in space. So it helps to identify late planted areas because of late recession of floods or preceding crops vacating the main fields late in the season.

Adoption of RCTs offers opportunities for reducing turn-around time for crop establishment. An attempt was made for estimating distribution of 'fallow lands' and acreage of early, timely and late planted crops during *rabi* season of 1999-2000 and exploring possibilities for introducing RCTs in such areas which otherwise are difficult to plant any crop.

Temporal satellite data (IRS 1D, WiFS Sensor of November, January, March, and April months during *rabi* season, 1999-2000) of Bhagalpur district, Bihar, were used to derive temporal growth profile of various crops for their discrimination and spatial distribution (Fig 1). Digital image processing of satellite data was done using ERDAS Imaging (*ver.* 8.6) and ground truthing was carried out using GPS (Lieca GS 5). Digitized map of Bhagalpur with village boundaries prepared using ARCGIS (*ver.* 8.3) was overlaid to retrieve the information about late planted crops and fallow lands for using RCTs at village level. Study revealed that 59 per cent of total geographical area of Bhagalpur district, is covered by various agricultural crops and remaining 41 per cent includes built up area, orchards/plantation areas, barren and fallow lands, river, waterbodies etc. Out of 59 per cent under cultivated area, wheat was the dominating crop covering 20 per cent followed by maize (12 %) and pulses (10 %). In wheat growing areas, about 2, 12 and 6 per cent area was occupied by early, timely and late sown wheat respectively. Similarly in maize crop, 8 and 4 per cent was in timely and late sown categories respectively. Winter maize and wheat is grown mostly in flood plains close to river bank (locally known as *diara* land), pulses (mainly chick pea and lentil) are common in areas called *tal* lands. Arhar crop sown during May/June if not damaged by flood remains in the field upto late March/early April.

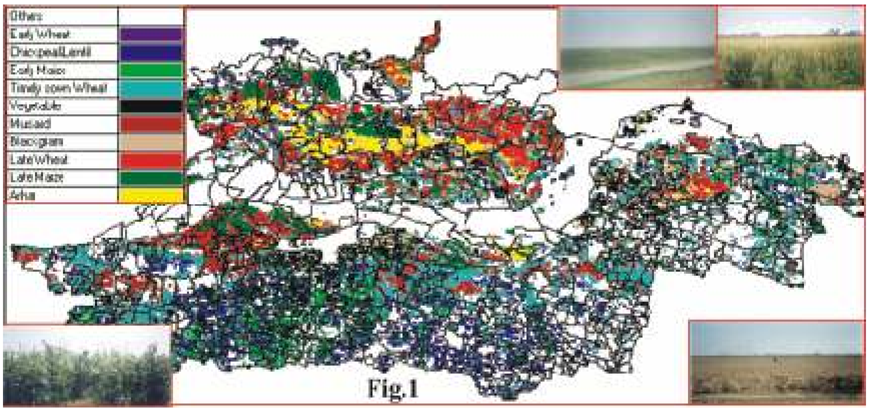


Fig.1

In Bhagalpur district floods are received from 3rd week of July to 4th week of September. Thus, *Rabi* crops (wheat, maize, chickpea, green peas, lentil, black gram, and Indian mustard) assume great significance for the farmers located in flood plains. In *diara lands* sowing schedules of main crops such as wheat and winter maize depend exclusively on recession of the flood. Early recession of flood allows farmers to take black gram followed by either late wheat or winter maize and summer maize. Black gram (chickpea)is a bonus crop as it is grown on residual soil moisture and fertility of the freshly deposited alluvium, without preparatory tillage. After harvest of chickpea farmers take a secure harvest of the summer maize before onset of next flooding season. Traditionally, in these areas, wheat is sown by broadcasting method (seed rate of 250 kg ha^{-1}) after five ploughings. Fertilizers are also surface broadcasted. Excessive ploughing delays wheat planting with consequent low yields. Initial results of farmer participatory trials in *diara* lands of Sabour block, Bhagalpur, conducted with support of the Rice-Wheat Consortium for the Indo-Gangetic Plains/CIMMYT, suggested that use of zero-till-ferti-seed-drill helped reduce tillage costs, and seed rate by about 150 kg ha^{-1}, and advanced planting time such as to improve crop productivity.

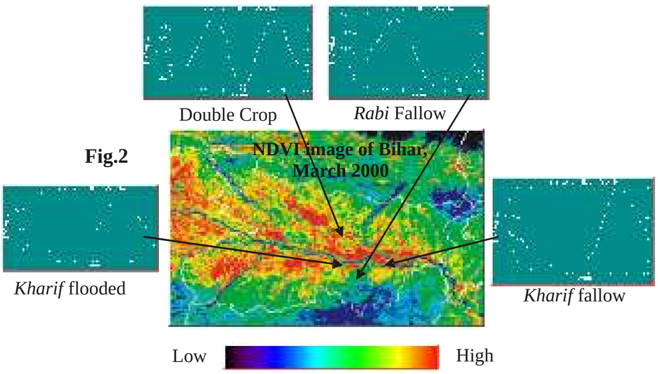


Fig.2

In areas where recession of flood is late and there is no time available for taking black gram crop, wheat crop is sown timely utilizing the residual soil moisture. It is followed by timely sowing of summer maize. In upland *diara* areas where risk of flood is minimal and land is available throughout the year, coarse or fine rice crop is taken during *kharif* season. Timely harvest of coarse rice leads to timely sowing of wheat crop. But the late harvest of fine rice during December results in late planting of wheat crop, which is not profitable for the farmer (Late transplanting delays harvest of rice). Hence, farmers either prefer to keep their lands fallow or grow vegetables in small parcels. 'Rice fallow' lands are the potential areas where adoption of RCTs will benefit the farmers most by increasing productivity of the system per unit area and time.

Analysis of vegetation index images (NDVI images derived from multispectral remote sensing satellite data of SPOT4 Vegetation) at 10 days interval from June 1999 to May 2000 helped identify mono and double cropped areas and fallow lands during *kharif* or *rabi* seasons (Fig 2). Mechanization of planting and harvesting would increase cropping intensity, and enhance productivity of the system significantly.

Thus satellite remote sensing could delineate fallow lands, late crop planting areas, and potential pockets for introduction and adoption of RCTs. The technique provides excellent information on flood recession time and temporal availability of lands for cultivation provided the remotely sensed optical data is for some cloud free period. For accurate estimates of land availability and planning planting schedules using RCTs, all weather capable microwave satellite remote sensing data of finer spatial and temporal resolution could be of great use.

R.N. Sahoo[1], R.K. Tomar[1], I.P. Abrol[2] and M.K. Wadhawani[3]

[1]*Division of Agricultural Physics, Indian Agricultural Research Institute, New Delhi;* [2]*Centre for Advancement of Sustainable Agriculture, Vasant Kunj, New Delhi;* [3]*Bihar Agricultural College, Sabour, Bhagalpur, Bihar*

Updates

Open Source Simple Computer for Agriculture in Rural Areas (Oscar)

The project aims to initiate cooperation between European and South Asian institutions for bringing IT&C to rural areas. This is done by helping to address the issue of declining agricultural productivity in South Asia by proposing a tool for decision-making in weed identification and control. This decision-making tool will target farmers of the Indo-Gangetic Plains (IGP) at village level and will effectively address the issues of local language by taking into account the cultural diversity of the populations of the targeted area. An existing software for species identification (IDAO) will be adapted to run on a low-cost computing device (a personal digital assistant (PDA), working with Linux - an open source operating system) that can be shared among farmers of a local community. A model database for identification and control of a set of the most important weeds of the IGP will be developed for integration with the species identification software. Perception of the tool by farmers will also be assessed in order to improve the tool's usage and appropriateness at farmer community level. Finally, at the end of 30 months, this project in its final workshop will formulate recommendations and formats for similar decision-making tools, in addition to a small prototype.

Potato Planter by the Wheat Research Centre, Dinajpur, Bangladesh

A power tiller operated potato planter has been developed by scientists (Harunur Rashid and Israel Hossain) of the Wheat Research Centre, Dinajpur, Bangladesh with technical assistance of CIMMYT scientists (Ken Sayre, Craig Meisner, Scott Justice, and Enamul Haque) and financial support from the CIMMYT Bangladesh and Asian Development Bank project being implemented through Rice-Wheat Consortium. This bed planter can make raised beds and ridges and sow wheat, maize, and pulses on the top of the bed simultaneously in the tilled soil. This year alone, there are more than 30 bed planters in growers' fields with a CIMMYT and FAO program. The major component of the planter is the toolbar frame, seed box with metering mechanism, furrow and bed shaper. The same toolbar frame has been used for making the potato planter. The major functional parts are cup potato planting mechanism, single row furrower, seed covering arrangement, and single depth control wheel. There are 13 pairs of rubber cups fixed in opposite directions in a flexible flat threaded belt. Metering mechanism is operated by chain-sprocket powered from the tiller wheel axle. Seed potatoes are held in a box with an inclined base facilitating potato seeds to move toward the moving cups and automatically deliver seed-potatoes with a seed-to-seed distance of 25 cm. The planting depth is adjustable.

2-wheel tractor compatible potato planter attachment in Bangladesh means its reach to major farmers there for crop diversification

Readers might ask a question that what in the world CIMMYT and RWC are doing working with potatoes!! This was made possible with the growing realization of necessity to work in cropping systems perspective and address the growers' needs accordingly. The bed planter is just that instrument that can sow wheat, maize, lentils, legumes, and with a special attachment, now potatoes. This might be the only flexible bed planter for a 2-wheel tractor working on growers' fields in the world. Readers might be interested to know that the current 2-wheel tractors in Bangladesh had originated from China as Dong Fang or SaeFang tractors. The CIMMYT's initiative made a difference in getting a distinct recognition which otherwise was expected to happen from the originating place of the tractors itself.

Harunur Rashid and Israel Hossain
(WRC Dinajpur, Bangladesh) and
Ken Sayre, Craig Meisner, Scott Justice, Enamul Haque
(CIMMYT, Mexico)

News Room

Field Seminar on Mechanical Parachute Transplanting of Rice

In 'Parachute transplanting' rice seedlings raised on a small pallet of soil filled into plastic bubble cups are tossed into air for transplanting in the main filed. The Directorate General Agriculture, On-Farm Water Management (DGAOFWM) has devised a method by which rice seedlings are blown high into the air to make them land upright in puddled field. This method saves labour, and is quick and cost-

affective. This technique was first introduced to national scientists by the RWC during a travelling seminar to Sichuan Province of China in 2000.

Dr Mushtaq Ahmad Gill, DG-Agriculture organized a field seminar at Pindi Rattan Singh on 15th July 2002 and demonstrated to farmers from Gujranwala, Lahore, and Sheikhupura the mechanical broadcasting of rice seedlings in puddled / unpuddled fields. Local farmers impressed with the simplicity of parachute rice transplanting and zero till wheat have named these technologies as 'Gill Technologies' in recognition of the services rendered by Mushtaq Ahmad Gill and his colleagues. OFWM has been at the forefront of introduction and dissemination of resource conserving technologies in Pakistan. In a series of field demonstrations, OFWM, organised the latest on parachute transplanting on 30th September , 2003 at Khushi Muhammad farm at Muredkay with support from PARC/NARC, and machinery manufacturers with the financial assistance of NZAID/CIMMYT project. In fact the above field demonstration also focused on several other resource conserving practices such as bed planting and direct seeded rice.

Public-Private Interface Meet in Karnal

National Rice-Wheat coordinator, Dr. Jagsoran, Directorate of Wheat Research, Karnal convened a workshop of zero-till drill manufacturers on 19 October, 2003 to facilitate a dialogue between private entrepreneurs, state departments of agriculture , researchers and extensionists . The one-day workshop was attended by 48 entrepreneurs from the states of Haryana, Punjab, U.P. and Bihar, and scores of scientists and extensionists from ICAR institutions and state agricultural universities and departments of agriculture to share concerns of raw materials, transportation and demand of drills, quality controls, after-sales services of zero-till and bed planting machines manufactured indigenously. In workshop chaired by Professor SL Mehta, National Director (NATP) important decisions on quality control aspects, servicing of the drills and accelerated dissemination of technologies were taken. Some of the machinery manufacturers agreed to open outreach service centres in eastern Gangetic plains where no-till agriculture has found new niche and is becoming very popular amongst farmers. Prof. Mehta agreed to open two quality control referral workshops, one in Punjab and the other in Haryana and arrange training of local artisans in drill manufacturing at Central Institute for Agricultural Engineering, Bhopal. National Agricultural Technology Project (NATP) would conduct a training and travelling seminar on machinery issues in IGP in April/May, 2004 to facilitate interaction of drill manufacturers with the practitioners of zero-till agriculture. Private manufacturers of agricultural implements agreed to organise a 'Farm Fest' in Punjab/ Haryana in 2004 for display and dissemination of information on the range of farm machinery developed recently.

West Bengal Two-Wheel Tractors Stakeholders Meeting

A stakeholders meeting was held after a West Bengal tour at The Park Hotel, Kolkota, on 29 July, 2003. Scientists, engineers, importers, a NABARD bank official, and CIMMYT

Nepal and Bangladesh staff attended the meeting. In the meeting, four presentations on the South Asian regional scenario on conservation agriculture and mechanization efforts by CIMMYT and RWC, Nepal farmer participatory project, and institutions of two-wheel tractors in Bangladesh, and India were made. The meeting identified major issues and concerns of stakeholders. It was felt that despite the high prices, power tillers are still ahead of four-wheel tractors in West Bengal due to small and fragmented holdings. Participants agreed to launch awareness campaigns to encourage adoption of power tillers in parts of West Bengal where they are absent. Low adoption rates of power tillers in West Bengal was attributed to lack of awareness and higher prices in comparison with Bangladesh and Nepal. Support from international organizations like CIMMYT and IRRI was felt necessity for development of accessories for the 2-wheel tractors.

A Double Disk Zero-till Ferti-seed Drill Developed

Mr. Aroor Singh, owner of A.S. S. Foundry, Amritsar, Punjab has developed a double disk zero-till ferti-seed drill with technical support from Joseph Rickman, Raj Gupta and Ken Sayre. The new seed drill mounted on three bar steel frame opens a very narrow slit in moist or dry soil without a pre-opener coulter. The detachable double steel disk openers can be mounted even on the existing zero-till drills. To facilitate cutting action of the disks they are spring loaded with the machine frame. Field trials have been conducted in presence and absence of loose residues and also in sugarcane field for wheat planting. Initial results on seed germination have been very encouraging as compared with 'inverted T' or chisel type zero-till openers in field situations after a pre-sowing irrigation. Using the double disk zero till drill it is now possible to seed in 4-5 ton anchored and loose residues or where in previous rice crop has lodged.

The new machine can be used interchangeably as zero till drill with chisel or double disk openers or as bed planter . The new drill costs with 3 different functions costs around US $ 1000.

Earlier M/s Dasmesh Mechanical Works, Amargarh, Punjab had developed a compact notch type double disk zero-till ferti-seed drill with technical support from PAU Ludhiana. The cost of the Dasmesh zero-till drill is around US$1600.

Modular Light Duty Power Tiller Developed

Agriculture in the hills is usually practiced on terraces of different grades made on sloppy lands. The dimensions of the terraces often vary to fit sloppy landscapes. Because of difficulties in shifting of large sized power tiller or tractors between terraces, farmers have to depend on animal power or even resort to manual ploughing by spade. Lack of mechanization, often delays operations in hill agriculture, resulting in low crop productivity. In order to meet the long felt need of farmers practicing terrace agriculture in upper catchments of the Gangetic plains, Er. Baldev Singh of Amar Agro-Industries, Ludhiana, Punjab, has developed a 'Modular light duty power tiller" for promoting terrace agriculture with technical feedback from RWC, Dr. KP Singh (VPKAS, Almorah) and Er. Srimat Sreshtha (NARC Kathmandu).

Modular PT being tested on a terrace (a) and an updated version (b).

Modular power tiller is a self-propelled machine consisting of a petrol start/Kerosene run, 5.5 H.P engine, a 50 cm wide rotavator with 16 interchangeable C type or straight blades and chisel type zero-till openers. For tilling operation, four C shape blades are to fixed on each of the 4 flanges fitted at a fixed spacing of 10 cm. However if the rotavator is to be used along with seed-drill, then 12 straight shaped blades are fixed on 3 flanges spaced 15 cm apart along with chisel type zero-till openers fitted to a seed drill. Fluted roller mechanism and a agitating type gravity mechanism delivers seed and fertilizer through 3 tubes fitted with ZT openers. The machine moves forward at a speed of 2 km/hr. The machine casting INR40K can be used as rolavator rotavator seeder, or as Zerotill drill.

Integrated Use of Micro-hydro-turbine and Resource Conserving Technologies in Rural Development

Indo-Gangetic Plains have several mighty rivers and many small perennial natural drains that flow throughout the year. If flow energy of water in small rivulets is harnessed, approximately 0.4 MW of electric power can be generated for promoting agricultural production in remote

Double disk planter: Wheat planted with double disk drill in the residues of lodged rice crop (a) and field a month after sowing (b).

country sides. Using principle of modern waterwheel, hydraulic turbines have recently been developed to generate hydropower. A turbine is a rotary engine that uses the flow of fluid (either gas or liquid) to turn a shaft that drives machinery. Hydraulic turbines convert the energy of an elevated water supply or flowing stream into mechanical energy on a rotating shaft. Flowing or falling water strikes a series of blades or buckets attached around a shaft. The shaft rotates and gives motion to the rotor of an electric generator or the centrifugal pump to lift water. Whereas old-style water wheels used water weight directly, modern hydraulic turbines operate either on impulse or reaction principles, which convert pressure and kinetic energy of water to rotational kinetic energy. Kinetic turbines, which exploit only the kinetic energy of flowing water, are now being considered for commercial exploitation.

Water wheel installed at Jagdishpur, Sonepat, Haryana on a waste water drain.

Dr. SubbaRao and Mr. Anand Krishnan, Department of Mechanical Engineering, Indian Institute of Technology, New Delhi, improved the design of old 'Mangal Water Wheel' by improving the design of blades, reducing size of turbine to make it portable and make the unit more cost effective to put it within reach of small farmers. Besides the check-dam, the new complete micro-hydro-turbine costs about US$ 1000.

Shantanu Mathur, Coordinator, IFAD, Rome, discussing benefits of re-use of waste water in raised bed planting system with scientists of the Haryana Agricultural University, Hisar.

The micro-hydro-turbine technology is being used to lift irrigation water from free flowing perennial drainage channels. Lifted water supplies are used in conjunction with other resource conserving technologies such as zero-tillage and raised bed furrow irrigation systems (FIRB). These technologies after integration are being used to recycle waste water supplies in crop production near Sonepat town in Haryana India under the aegis of IFAD funded water wheel project of RWC/CIMMYT India. The two technologies together help apply irrigation water in small volumes, save diesel in pumping and also aerate the pumped water supplies.

P.M.V. SubbaRao, Anand Krishnan, S.S. Dahiya and Raj Gupta

For additional details please contact P.M.V. Subbarao (pmvs@mech.iitd.ernet.in), Plappally Anand Krishnan (plappally@yahoo.com or r.gupta@cgiar.org)

Bookshelf

Gupta, R.K. et al., 2003. Zero-Tillage in Rice-Wheat Systems: Frequently Asked Questions. Technical Bulletin No. 6, Rice-Wheat Consortium for the Indo-Gangetic Plains, New Delhi-110 012, India. pp 28.

PARC-RWC. 2003. Proceedings of the National Workshop on Rice-Wheat Systems, Islamabad, Pakistan. 11-12 Dec 2002. Pakistan Agricultural Research Council and Rice-Wheat Consortium for the Indo-Gangetic Plains, New Delhi, India. pp. 112.

Awards and Honours

DR PRADEEP K. SHARMA ELECTED NAAS FELLOW. Dr Pradeep K. Sharma, Chief Scientist (Water Management), CSK Himachal Pradesh Agricultural University, Palampur, has been elected as a fellow of the prestigious National Academy of Agricultural Sciences, New Delhi, for his significant contribution in the field of soil and water management in rice-wheat cropping system. Dr Sharma found that conservation agriculture was more remunerative than conventional tillage for wheat in post-rice soils. Using an irrigation criteria for rice and wheat developed by him, irrigation water to the tune of 40 per cent can be saved.. Dr. Sharma is recipient of several other recognitions for his work on water management .

Announcement

IRRN Best Article Awards

What better way to celebrate the International Year of Rice (IYR) than to honor the people who work in rice research. Rice researchers work quietly in the fields and laboratories, conducting studies that they hope will make a difference in the lives of millions of rice producers and rice consumers all over the world. In its 28-year existence, the *International Rice Research Notes* (*IRRN*) has been an active partner in bringing the fruits of their labor to the scientific community. To commemorate 2004 as IYR, the Best Article Award is being established to recognize the contributions of rice researchers from national agricultural research and extension systems (NARES) in developing countries toward the advancement of rice-related knowledge and technology.

Beginning in August 2003, papers submitted for publication in the *IRRN* will be evaluated on the basis of scientific content, originality, relevance, and organization. There will be up to six winning papers from the six sections of *IRRN*—plant breeding; genetic resources; pest science and management; soil, nutrient, and water management; crop management and physiology; and socioeconomics. The winners will be chosen by the *IRRN* Editorial Board and invited reviewers. The winning entries will be announced in the October 2004 issue of *Rice Today* and will be published in the December 2004 issue of *IRRN*.

The competition is open to all NARES rice researchers. The Award will be given to the first author of each paper. Additional authors may come from any organization. Research for all categories must have been conducted in a developing country. Each winner will receive a $500 cash prize.

The deadline for submission is 31 July 2004.

For details, contact the
IRRN Managing Editor
IRRI, DAPO Box 7777
Metro Manila, Philippines
Fax: +63 (2) 580-5699; 891-1174
E-mail: t.rola@cgiar.org

RWIS is a half yearly newsletter aimed at providing information about various activities, projects, technologies developed and other events of significance in rice-wheat arena. It is brought to you by the Rice-Wheat Consortium for the Indo-Gangetic Plains (RWC), an ecoregional program of CGIAR.

Contact address: CIMMYT-RWC, CG Block, NASC Complex, Todapur Road, New Delhi-110 012, India.
Ph.: 91-11-25847432, 25842940, Fax: 91-11-25842938

Visit us at: http://www.rwc-prism.cgiar.org