IRAQ-ICARDA-AUSTRALIA Project

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Better Crop Germplasm and Management For Improved Production Of Wheat and Barley

Implemented by DOA in Ninevah & Mosul Univ.

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Experiences
with the No Tillage method

1 – NO-Till in Australia

- **The Western Australian No-Tillage Farmers Association (WANTFA) estimated that 40 per cent of farmers in WA may have no-tilled in 1998.**

- **What is no-till ?**
- **No-till is sowing a crop without prior cultivation and with very little soil disturbance at seeding.**

(NO-Till in Australia cont.)

- **Why no-till ?**

- **The main benefits of include no-till, with appropriate agronomic management**
- **almost no soil erosion through stubble retention and proper grazing management (especially in sandy soils).**
- **greater flexibility of farm operations through less time used at seeding and improved soil structure and more timely seeding and other operations.**
- **more water harvested to grow the crop in dry areas; less labour, fuel and machinery costs per hectare .**

(NO-Till in Australia cont.)

- **On which Soil ?**
- **All soils can be no-tilled! In sandy soils, no-till with stubble retention minimises wind erosion and where it leaves furrows, makes water harvesting easier in water repellent soils.**
- **In clay and loamy soils, no-till minimises run-off and erosion by water and improves soil structure .**

(NO-Till in Australia cont.)

- **Pre-season preparation**
- **By controlling weeds, which are hosts to diseases, problems with both weeds and diseases are reduced. However, the year before seeding good stubble management is also essential.**
- **(Ross et . al . (1999) No-Till Essentials – Miscellaneous publication – Australia).**

(NO-Till in Australia cont.)

- **Stubble retention :**
- **The retention of crop residues has built up slowly as a practice in Western Australia over the 1980's & 1990's in place of incorporation or burning. Adoption has been mainly a response to wind & water erosion hazards & to the decline in soil structure . Recorded yield increases due to stubble retention in Australia have been variable, & not always positive in the short term . However, experimental evidence is beginning to emerge after some years of stubble retention that soil prosperities & grain yield have increased compared with annual burning of stubbles**.

(NO-Till in Australia cont.)

- **Zero tillage :**
- **The use of no-or zero tillage (i.e. sowing with virtually no soil disturbance, with or without stubble burning) has been widely adopted in Western Australia since the early 1990's as a logical extension of the earlier developments in reduced tillage & one-pass seeding. There is little published evidence teat crops sown on the same day using a zero-tillage system as those sown with some form of cultivation have resulted in yield increases. However, the saving in fuel cost, & the convenience of being able to sow closer the optimum time have contributed to profits in many circumstance. The system is dependent the use of chemical weed control & along with several other modern practices, has contributed to the development of herbicide-resistant weeds, thus extending a farther challenge to farm managers researches.**
- **(Anderson et . al (2005) The role of management in yield improvement of the wheat crop-are view with special emphasis on WA - Australian of Agric . Research ,56 ,1137-1149)**

2 – NO-Till in USA

Soil erosion by water or wind is a serious problem on approximately one million acres of land in California's hills and valleys traditionally used for production of barley and wheat. Exposure of tilled soil on sloping ground can result in erosion and lead to loss of productivity and transport of sediment into streams and lakes even where total annual rainfall is very low. Although there are several options available to farmers for protecting soil from erosion, nationally, farmer shave chosen methods that use crop management on approximately 75 percent of the acres covered by conservation compliance plans .Crop residue management methods in clued several types of conservation tillage, including no-till .

(NO-Till in USA cont.)

- **In California, many small grain producers use minimum tillage, reducing the umber of tillage operations, adjusting chisels, discs, and cultivators to leave sufficient crop residue levels to qualify as conservation tillage according to USD definitions. A small number of grain farmers are using no-till.**

(NO-Till in USA cont.)

- **In no-till farming, as the name implies, tillage for seedbed preparation and weed control is avoided entirely. The only mechanical disturbance to soil is in a narrow slot or strip made by the planter or by fertilizer knives. Weeds are controlled with herbicide applications instead of with tillage. Potential advantages of no-till besides a reduction in soil erosion - are a reduction in use of fuel (due to less cultivation) and increased capture of runoff due to improvement in tilth of the soil surface .**

(NO-Till in USA cont.)

- **some no-till growers believe that in no-tilled fields (due to improved in filtration and reduced run-off enough moisture is stored in the root zone that back-to-back cropping becomes possible where under conventional tillage, a moisture-conserving fallow was necessary. Moisture availability aside, two potential advantages of reducing the frequency of fallow are (1)greater production of crop residues (2) production of income every year.**

(NO-Till in USA cont.)

- **Fertilization in No-Till Systems :**
- **Both N and p fertilizers should be placed in sub-surface bands rather than be broadcast on the surface . This is good advice regardless of the tillage system , but it is especially true fir no-till . plant residues present on the surface of the soil in a no-till system will immobilize inorganic forms of (due to microbial activity).**

(NO-Till in USA cont.)

- **Impacts on Soil Organic Matte:**
- **Reduced tillage systems affect the distribution of organic matter in the soil, increasing the organic matter and nitrogen content of the surface soil compared to conventional tillage . This is a result both of reduced contact of residues with soil microbes matter to oxygen In one study , researchers measured 43% more total N in the top two inches of soil in unfilled soil compared to conventionally tilled soil after six years of tillage differential .**

(NO-Till in USA cont.)

- **Impact on Water Infiltration and Water – Holding Capacity :**
- **Some growers in California and elsewhere state that in no-tilled fields ,they see less runoff and better water infiltration .**
- **(pettygrove et . al . (1995) No-Till wheat and Barley production in California – Univ. of California Energy commission)**

3 – NO-Till in AFRICA

Changing from Conventional to Conservation Tillage :

- **Before starting with conservation tillage CT soils have to be corrected. This means that major constraining factors caused by conventional tillage have to be adjusted.**
- **Breaking of soil compaction layers especially plough layers or hoe pans By :**
- **Mechanical measures :subsoiling by use of tractors or draught animals.**
- **Biological measures :fallows with plants forming taproots which can penetrate and break the hardpan (e.g. pigeon pea ,oil reddish) Adjustment of PH - application of lime farm yard manure.**

(NO-Till in AFRICA cont.)

- **The Main Function of soil organic matter (SOM) :**

- **Improvement of soil structure .**
- **Increased water storage capacity .**
- **Slow release of plant nutrients .**

(NO-Till in AFRICA cont.)

- **Major Effects of Conservation Tillage on Soil characteristics:**
- **Reduced soil erosion by wind and water.**
- **Reduced water run - off = loss of water.**
- **Increased water infiltration and storage.**
- **Reduced evaporation.**
- **Prevention of overheating of the soil surface affecting seed germination .**
- **Build up of SOM.**
- **Improved aggregate stability and soil structure, but increased bulk density.**
- **Deepening of rooting horizon through earthworms and roots of deep rooting green manure plants.**

(NO-Till in AFRICA cont.)

- **Soil life:**
- **The soil must be understood as a living organism. Only A living soil, with abundant soil life ,can fulfil its main functions. Tillage operations disturb the soil life. Soil organisms are suddenly exposed to the sun, heat, and drought . The number of soil biota decreases rapidly and builds up only slowly during the growing season. Under No-tillage and to a lesser extent under minimum-tillage soil life is not disturbed. The soil cover helps to create a more stable environment and the organic matter serves as 'fodder" for the soil biota .**

(NO-Till in AFRICA cont.)

- **Soil biota improve the soil structure .The micro fauna and flora improves the soil structure by forming stable soil aggregates , while the macro fauna forms macropores which are important for water infiltration and aeration .**
- **(Kurt S. (2002) Conservation Tillage Gateway to food security and sustainable Rural Development Impact of Conservation Tillage on soil Quality . Univ of Zimbabwe)**

4- NEW TILLAGE PRACTICES FOR SOUTH ASIA

- **For decades the continuous rotation of rice and wheat-two crops or more per year has provided food and livelihoods for hundreds of millions of rural and urban poor in South Asia. Now a crisis looms. The population is growing at more than 2% (nearly 24 million additional mouths to feed) each year. Yet agricultural land area dwindles and yield increases are leveling off. In the next two decades, fresh water will become increasingly scarce in South Asia, and water tables in some areas are already dropping as much as one meter per year. Finally, heavy diesel use and crop residue burning pose local health hazards and add significantly to global warming.**

(New Tillage Practices For South Asia cont.)

- **SIMPLE CHANGES, ASTONISHING BENEFITS:**
- **Alternative tillage practices that reduce costs and raise productivity are being tested and promoted by the Rice-Wheat Consortium for the Indo- Gangetic Plains (RWC) It turns out that widespread adoption of one or several of these reduced tillage methods will also bring significant environmental benefits.**

(New Tillage Practices For South Asia cont.)

- **For example, current land preparation practices for wheat after rice involve as many as 12 tractor passes. Changing to a zero-till system on one hectare of land would save 98 liters of diesel and approximately 1 million liters of irrigation water. Using a conversion factor of 2.6 kg of carbon dioxide per liter of diesel burned, this represents about a quarter ton less emissions per hectare of carbon dioxide, a principal contributor to global warming.**

(New Tillage Practices For South Asia cont.)

- **These benefits increase dramatically if extended across even a portion of the rice-wheat region's 12 million hectares. Adoption of zero-till on, say, 5 million hectares would represent a savings of 5 billion cubic meters of water each year. That would fill a lake 10 km long, 5 km wide, and 100 m deep.**
- **In addition, annual diesel fuel savings would come to 0.5 billion liters - equivalent to a reduction of nearly 1.3 million tons in CO2 emissions each year.**

(New Tillage Practices For South Asia cont.)

- **Scientists in the RWC are also working with farmers to cut down on the burning of crop residues, which amount to as much as 10 t/ha, producing some 13 ton of carbon dioxide.**
- **Eliminating burning on just 2 million hectares would reduce the huge flux of yearly CO2 emissions by 17 million tons.**
- **Leaving stubble on the field, rather than burning it or incorporating it, also leaves a better habitat for beneficial insects to proliferate - a benefit that has not yet been quantified.**

(New Tillage Practices For South Asia cont.)

- **HOW LIKELY ARE THESE SCENARIOS:**

- **Alternatives to burning residues are still in the exploratory stage, but reduced tillage practices are catching on quickly, simply because they are so attractive to farmers. For example, two methods promoted by the RWC - direct drilling and surface seeding—allow farmers to prepare soils and sow wheat in as ingle tractor operation after the rice harvest. How can one argue with a practice that saves 75% or more fuel, obtains better yields, uses about half the herbicide, and requires at least 10% less water? Farmers save at least US$ 65/ha in production costs, which makes a big difference to their profit margin.**

(New Tillage Practices For South Asia cont.)

- **This year, farmers used direct drilling with locally manufactured drills to plant 8,000 ha in Haryana, India, and 5,000 ha in the Pakistan Punjab. The area of adoption has increased ten-fold each year for several years.**
- **The main constraint on more rapid expansion has been a lack of good quality, fairly priced seed drills. Small private shops are beginning to produce more drills in response to rising demand.**

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(New Tillage Practices For South Asia cont.)

- **Small-scale mechanization is also spreading in the form of the two-wheel tractor and a range of new implements. Used widely by smallholders in China and Bangladesh, two-wheel tractors are being tested as a one-pass, reduced- tillage system and apted by farmers in Nepal and eastern India for more timely sowing and reduced labor and land preparation costs. Here the need is for more tractors, repair' shops, mechanics, and credit support to purchase equipment.**

(New Tillage Practices For South Asia cont.)

- **Another recently promoted technique—planting wheat on raised beds—improves yields, increases fertilizer efficiency, reduces herbicide use, saves seed, saves an average 30% water, and can reduce production costs by 25-35% when permanent beds are used. Bed planting is gaining acceptance in Pakistan and is being tested by researchers in India and Nepal.**

(New Tillage Practices For South Asia cont.)

- **To help make seed drills, hand tractors, and tractor implements more widely available, RWC staff are linking and advising farmer groups, local machine shops, and agricultural engineering specialists. CIMMYT and the RWC are also developing appropriate planters and bed-shaping equipment so that farmers can maintain permanent beds and retain crop residues. This adds the advantages of conservation tillage to bed planting, reducing costs another 20-25%.**

(RaJ G . and peter H . – CIMMYT _ Nepal) .

Materials and Methods

- **The following tables (from A-L)shows the varieties which were used in demonstrations and control treatments according to locations and planted area including details of all activities such as ploughing , amount of seeds (Kg/hec.) , Date of sawing and fertilizer dosages….etc.**