Comparison of Different Tillage practices among various Wheat Varieties

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ABSTRACT

Sowing of wheat in residual moisture through zero tillage technology not only facilitates the germination but also improves the soil fertility, soil physical properties and saves time hence increases net return on sustained basis. It causes minimal disturbance of soil structure and texture ultimately increases size of soil aggregates. Zero-tillage also reduces the cost of production and saves time for sowing of wheat by 10-15 days as compare to conventional tillage. The minimum tillage and direct drilling system is energy and cost saving and environmentally friendly reducing the soil pollution as compared to conventional tillage practices. In case of conventional tillage system thermal conductivity, bulk density and compaction of soil increases due to use of heavy agricultural machinery which reduces infiltration rate, soil porosity and plant growth. Zero tillage is superior over conventional tillage because higher yield were recorded on zero tillage farms than that of conventional tillage wheat farms in addition to its edge of eco-friendly practice. Little amount of plant residue changing into microbial mass in case of conventional tillage system, because tillage increase the CO2 emission from soil which badly disturbs and slows down the microbial activity. Seed placement is important for its suitable germination and nutrients absorption. In case of deep placement most of the seeds remains dormant due to less availability of oxygen and sunlight, ultimately recommended population cannot be attained. In zero tilled field placement of seed is ensured at proper depth with zero-tillage drill. Zero tillage technology can help to reduce the weed infestation and also enable timely seeding of the wheat crop. Zero till wheat is being introduced to avoid late planting and poor land preparation. It ensures timely planting, better stand establishment and higher grain yield than conventional method. It also saves 30% on irrigation and land preparation costs.

Introduction
Tillage

Tillage is mostly conventional in wheat production and expected to be improved by this research. Adoption of conservation practices by U.S. Pacific Northwest growers to meet farm bill legislation for erosion control is limited by the inability to control weeds and other pests in cereal and pulse crops. A 6-yr, 16-ha integrated pest management field study was conducted in the sub humid wheat area of the Pacific Northwest from 1985 through 1991 to develop a crop production system that controls weeds effectively and reduces soil erosion. Farm-size machinery were used to till, plant, and harvest crops grown in either a continuous wheat (Triticumaestivum L.) sequence or a 3-yr rotation of winter wheat-spring barley (Hordeumvulgare L.)-spring pea (Pisumsativum L.) in conservation and conventional tillage systems. Minimum, moderate, and maximum weed management levels were superimposed over each cropping by tillage system. Position of winter wheat within a cropping system influenced yield so that wheat produced more grain following spring pea > spring wheat > winter wheat. Insects and root diseases were not yield-limiting factors in either conventionally tilled monoculture wheat or no-till wheat in the 3-yr cropping system. Yield of winter wheat in the conventionally tilled, continuous wheat system was similar for all three weed management levels. Yield of winter wheat in conservation tillage systems increased at both the moderate and maximum level of weed management levels compared with the minimum level. No-till winter wheat planted after either pea or spring wheat at the moderate and maximum weed management levels yielded a minimum of 605 kg ha⁻¹ more than conventionally tilled wheat at
the same management levels (Young et al., 1994). Jongdee et al. (1994) carried out field experiment in Northern Thailand and indicated that wheat sown in seedbed prepared by conventional tillage produced higher wheat than zero tillage. However, when rice straw mulch was spread after sowing, the wheat yield obtained from zero tillage was significantly higher than conventional tillage method of sowing.

To check the combined long-term effects of tillage method, crop rotation, and nitrogen (N) fertilizer rates on grain yield was studied between 1994 and 1998 in a rainfed Mediterranean region. Tillage treatments included Zero-tillage (ZT) and conventional tillage (CT). Crop rotations were wheat–sunflower (WS), wheat–chickpea (WCP), wheat–faba bean (WFB), wheat–fallow (WF), and continuous wheat (CW). Nitrogen fertilizer rates were 0 kg ha\(^{-1}\), 50 kg ha\(^{-1}\), 100 kg ha\(^{-1}\) and 150 kg ha\(^{-1}\). A split–split plot design with four replications was used. Heavy rainfall during this research negatively impacted vegetative growth and grain yield of the wheat due to waterlogging. Wheat yield in the wet years was higher under ZT than under CT. Yield decreased in the following crop rotation sequence: WFB>WF> WS >WCP>CW. Wheat yield at 100 kg N ha\(^{-1}\) was higher in wet years than the dry years. Yield under ZT was higher at 100 kg ha\(^{-1}\) N rate applied to wheat. The effect of N fertilizer on yield was more marked for the rotations with no legumes (Lopez-Bellido et al., 2000).

Camara et al. (2003) conducted a five years trial to determine whether some soil physical and chemical properties and microbial activity were affected by two conservation tillage system. Two crop sequences, corn-wheat/soybean and wheat/soybean, under chisel ploughing and no-till were evaluated; the results indicated that no differences were found in microbial respiration either in crop sequence or in tillage systems. Two large experiments were conducted near Florence in USA, to determine the yield response of cotton. Crop was grown with conventional and conservation tillage with residue covers of cotton stubbles, rye winter crop stubbles. In second experiment, a wheat and soybean double crop system was grown with different surface and deep tillage treatments and these treatments were compared against two years wheat-soybean maize rotation. Interaction occurred for yield between soil management factors and soil for cotton and wheat yield, but not for soybean. Data indicated that across the soil map units, the yield response to residue management input were more predictable with conservation tillage than conventional tillage (Bauer et al., 2002).

Chan et al. (2002) studied the effect of different tillage (direct drill vs conventional till) and stubble management (stubble retained vs stubble burnt) on soil carbon fraction over the 19 years. It was concluded that tillage and stubble burning lower the different organic carbon fractions and water stability of aggregate. Different experiments were conducted on tillage systems: conventional tillage, minimum tillage (herbicide and tillage) and delayed minimum tillage. Results of five years study showed that there were no differences in grain yields among tillage systems in any year (Jeffrey et al., 2002).

An experiment was conducted to evaluate suitable sowing method amongst broadcasting dry seed in standing water, broadcasting soaked seed in standing water, broadcasting soaked seed in standing water after hoeing, broadcasting dry seed after land preparation, sowing by drill after land preparation and sowing by drill on zero tillage. Results indicated that minimum numbers of tillers, productive tillers and number of grain spike\(^{-1}\) were obtained in case of broadcasting soaked seed in standing water and broadcasting dry seed or sowing by drill after land preparation. Maximum grain and straw yield was recorded in case of broadcasting soaked seed in standing water and broadcasting dry seed or sowing by drill after preparation while broadcasting dry seed in standing water produced the lowest grain and straw yield. Highest harvest index of 29.17% was calculated in case of sowing by drill on zero tillage. Maximum net income of Rs. 10968.68 ha\(^{-1}\) and benefit cost ratio of 1.53 were obtained by broadcasting soaked seed in standing water while broadcasting dry seed in standing water gave the lowest net income of Rs. 6870.32 ha\(^{-1}\) and benefit cost ratio of 1.34 (Iqbalet al., 2003).

A field experiment was conducted in India to check the effect of tillage on growth, yield and nutrient use in wheat (Triticum aestivum L.). Wheat crop was grown after various methods of rice seeding. Three methods of rice growing (direct seeding, manual transplanting and mechanical transplanting) were kept in main plots and three tillage levels (conventional tillage, reduced tillage and zero tillage) were kept in subplots. Results showed that bulk density in zero tillage (1.67 Mg m\(^{-3}\)) was significantly higher than reduced and conventional tillage which was 1.59 and 1.55 Mg m\(^{-3}\) respectively. High root density, dry weight of root and leaf area index (3.04) was recorded in conventional tillage. Significantly higher dry matter accumulation (254 g/m row) and leaf area index (3.02) of wheat were recorded in direct seeded rice and in conventional tillage practice. The highest mean yield of wheat (6.02 t ha\(^{-1}\)) was obtained in direct seeding of rice, followed by mechanical and manual transplanting. Amongst various tillage practices CT recorded the highest mean yield of wheat (5.90 t ha\(^{-1}\)) followed by reduced tillage (5.82 t ha\(^{-1}\)) and zero tillage (5.40 t ha\(^{-1}\)). Soil chemical analysis showed that significantly greater available soil N, P and K were recorded under direct seeding of rice followed by manual and mechanical transplanting whereas conventional tillage recorded significantly lower values of available soil N and higher values of soil P and K whereas zero tillage showed higher values of available soil N and lower values of available soil P and K during the 3 years of study (Gangwaret al., 2004).Bakhsh etal. (2005) conducted an experiment for the impact assessment of zero tillage technology in rice-wheat cropping system of Punjab, Pakistan and concluded that high grain yields and less cost of production per hectare of the zero tillage system was the most economical and attractive option for the farming community. Finally they suggested that zero tillage technology not only improved the farmer’s profit but also improved their livelihood and ultimately reduced their poverty.
Govaerts et al. (2005) performed an experiment on zero tilled wheat with residue retention, partial elimination and complete elimination and it was concluded from this study that wheat performed the best in zero tillage with residue retention and also statistically similar trends were observed in the case of partial and complete elimination with minimal yield differences.

Kosutic et al. (2005) also performed an experiment on three tillage systems which were conventional, reduced and zero tillage in wheat for the comparison of energy consumption and influence on yield. From this system they concluded that zero tillage system utilized 85% less (270.13 MJ ha\(^{-1}\)) energy as compared to conventional tillage system that was the greatest energy consumer with 1813.10 MJ ha\(^{-1}\), while in the case of yield the conventional tillage system gave significantly higher yields as compared with reduced and zero tillage system respectively.

A field experiment was conducted to examine the residual impact of tillage and farm yard manure on physical properties of soil and growth of wheat crop. Treatments were consisting of four tillage methods (Zero, Minimum, Deep and Conventional tillage) and three farm yard manure levels. FYM levels were control, FYM @ 10 and 20 Mg ha\(^{-1}\) respectively. Tillage methods significantly affected soil physical properties as they increased field saturated hydraulic conductivity while decreased bulk density of soil. Farm yard manure significantly affected the soil physical properties and growth of wheat as it increased field saturated hydraulic conductivity, thousand grain weight, straw and grain yields of wheat and decreased bulk density of soil (Iqbalet al., 2005).

An experiment was conducted on tillage systems and nutrient management influence on soil chemical properties and it was concluded that there is no difference in soil chemical properties in no-till (NT) and conventional till (CT) systems (Tarkalsonet al.,2006). A field experiment to check the effect tillage practices on water use efficiency, grain and fodder yield of oat and wheat at Livestock Research Station, Surezai, in province Khyber Pakhtunkhwa (K.P.K), Pakistan. There was non-significant difference among the grain, biological yield of wheat and fodder yields of oat under maximum tillage and in zero tillage system. The results indicated that maximum tillage had slightly improved the water use efficiency (WUE) as compared to zero tillage. Although similar moisture content in 0–30 cm upper soil was recorded in the maximum tillage and zero tillage treatments at all growth stages, however at lower depth the zero tillage treatment at seedling, 1st tillering, 2nd tillering, booting, anthesis, milk development and maturity stages contained 30.4, 24.15, 25.73, 13.81, 44.2, 32.0, 9.65 mm more water in the soil profile than maximum tillage treatments respectively. Therefore the tillage practices can be minimized to reduce the cost of cultivation (Wisalet al., 2006).

A 3-year experiment was conducted at the two sites (Foggia and Vasto) in southern Italy, under rainfed Mediterranean conditions to check the effect of zero tillage and conventional tillage on durum wheat. Parameters under study were grain yield, grain quality, thousand grain weight, protein contents and soil water contents. At Foggia in first two years higher grain yield was obtained with zero tillage than conventional tillage. In contrast, mean yield and quality parameters at Vasto were similar for both tillage practices, except in the third year in which conventional tillage (4.6tha\(^{-1}\)) produced moreyields than zero tillage (3.9 t ha\(^{-1}\)). 1000-grain weight was higher in zero tillage than conventional tillage in all years. Highest protein contents were obtained under zero tillage (19.6% and 15.5% for zero tillage versus 14.7% and 11.4% for conventional tillage respectively (during the growing season 2000–2001 and 2001–2002) because grain was shirveled due to low starch accumulation (Vita et al., 2006).

Field experiments were carried out to evaluate the effect of tillage and herbicides on weeds and wheat productivity under rice–wheat cropping system. Weeds population was significantly higher (12.1 plants m\(^{-2}\)) under conventional tillage compared to zero tillage (1.9 plants m\(^{-2}\)). Conventional tillage favored Phalaris minor. The average P. minor dry-weight under zero tillage and conventional tillage was 234.7 and 386.5 g m\(^{-2}\) respectively. Among the three tillage practices, zero tillage and conventional tillage drilled provided about 0.3 t ha\(^{-1}\) higher wheat grain yield over farmer’s practice of conventional tillage with broadcast sowing. The reduced expenditure on tillage and higher yield provided additional profit of about US $ 161.3 ha\(^{-1}\) for zero tillage over farmer’s practice. In CT, the performance of sulfsulfuron at 25 g ha\(^{-1}\), clodinafop at 60 g/ha and sulfsulfuron+metsulfuron at 25+1.6 g ha\(^{-1}\) was similar, where fields were dominated by P. minor. However, in ZT, overall tank mix application of sulfsulfuron+metsulfuron was the most effective treatment for control of the weed flora and improving wheat yield. Metsulfuron alone due to its effectiveness against broad-leaved weeds only was inferior. Considering the benefits of ZT in reducing the cost of cultivation and lowering the infestation of P. minor, this technology should be integrated with other weed control measures for economic and sustainable wheat production (Chhokaret al., 2007).

Sing et al. (2007) performed a field experiment to compare the effect of different herbicides in a zero-tilled wheat field and concluded that significantly lowest weeds population, weed dry matter and the highest grain yield were recorded by the utilization of paraquat 2-3 before sowing while adopting the zero tillage technology.

A field experiment at EnticHaploxeroll in Central Chile was conducted to evaluate the effect of 4 to 7-year-old conventional (CT) and no-tillage (NT) treatments on soil physical properties, root growth, and wheat yield. In both tillage treatments observations recorded were, soil water retention, bulk density, soil particle density, soil water infiltration, mean-weight diameter of soil aggregates (MWD), penetration resistance, grain yield, and root length density up to a depth of 15 cm. The MWD and the penetration resistance were higher under NT as compared to CT. For the top 5 cm of soil, root length
density was greater under NT as compared to CT. Differences of root length density between NT and CT were 2.09, 7.60, and 4.31 cm of soil during the phenological stages such as two leaves, flowering and grain filling, respectively. Generally, the effect of NT on these properties was more obvious near the soil surface. In contrast, fast drainage macro pores, particle density, and soil water infiltration rates were higher under CT than NT. Tillage treatments did not significantly affect bulk density and yield. A longer time under no-tillage improved aggregate stability, however, other soil physical properties were negatively exaggerated (Martinez et al., 2008).

Mishra and Singh (2012) performed 3-year (2006–2007 to 2008–2009) field study to evaluate the effect of four tillagesystems {zero tillage (ZT) in rice (Oryza sativa L.) and wheat (Triticum aestivum L.), conventional tillage(CT) in rice and wheat, and two rotational tillage sequences that alternated between CT and ZT} with three weed management levels (weedy check, recommended herbicide and herbicide + 1 hand weeding) in rice–wheat cropping system on a clay-loam soil. Continuous ZT increased the population density of bare ground grass [Echinochloa colona (L.) Link] and rice flat sedge (Cyperus iria L.) in rice butreduced the population of wild oats [Avena ludoviciana (L.)] and common lambsquarters (Chenopodium album L.) in subsequent wheat. Pendimethalin (1.0 kg a.i. ha\(^{-1}\)) fb 2, 4-D (0.50 kg a.i. ha\(^{-1}\))significantly reduced the population density of E. colona, C. iria and sessile joyweed [Alternanthera sessilis(L.) D.C.], but did not control pink node flower (Caesulia axillaris Roxb.) in rice. In wheat, clodinafop propargyl (0.06 kg a.i. ha\(^{-1}\)) fb 2, 4-D (0.50 kg a.i. ha\(^{-1}\)) significantly reduced the population of A. ludoviciana, but had no effect on toothed burclover (Medicago hispidaGaertn.). Continuous ZT resulted insignificantly higher yield of rice (2.94 Mg ha\(^{-1}\)), wheat (4.45 Mg ha\(^{-1}\)) and rice–wheat system (7.39 Mg ha\(^{-1}\)) compared to continuous CT (2.35, 3.86 and 6.21 Mg ha\(^{-1}\), respectively). For the totalsoil depth sampled (0–20 cm), weed seed population was significantly greater under continuous ZT (165 weeds 500 g \(^{-1}\) soil) and CT (101 weeds 500 g \(^{-1}\) soil), compared to rotational tillage (71–85 weeds500 g \(_{-1}\) soil). Rotational tillage systems significantly reduced the seed density of C. iria, A. ludoviciana andM. hispida compared to continuous ZT or CT. Total weed seed density was 66% lower in herbicide treated than in untreated plots. Continuous ZT with effective weed management using recommended herbicide + 1 hand weeding was more remunerative and energy efficient. These results suggest that conventional till-based rice–wheat system could be replaced with zero-till-based crop establishment method with effective weed control to save labor and energy in Vertisols of Central India.

**Varieties**

An experiment was conducted to evaluate six wheat varieties for their actual and potential grain yield. These varieties were Daman-98, Punjab-96, Inqilab-91, Khyber-87, Ghaznavi and Suleman 96. The results revealed that Daman 98 performed better than all other varieties. Correlation analysis made clear that except spike m\(^{-2}\), spike length, grains spike\(^{-1}\) and 1000 grain weight (g) increased the grain yield in all tested varieties (Khan et al., 2001). An experiment was conducted to study the effect of different seed rates on the growth and yield of some semi dwarf wheat varieties. The study comprised of three varieties viz., Zardana, Sonalika and Inqilab with three seed rates i.e. 100, 125 and 150 kg ha\(^{-1}\). Varieties showed no significant difference in mean plant height, numbers of tillers m\(^{-2}\), length and weight of grains per earhead. However, cultivar Zardana gave significantly higher grain yield per plant as compared to Sonalika and Inqilab. Seed rate had no significant effect on any of the parameters studied (Baloch et al., 2002). A two year experiment was conducted to test yield stability and adaptability of different wheat genotypes in rainfed areas of Kohat division. Results showed that maximum yield of grains were recorded in FD-91002 and Suliman-96 which was 4646 and 4243 kg ha\(^{-1}\) respectively. Maximum straw yield was also recorded in FD-91002 and Suliman-96 which was 6175 and 5760 kg ha\(^{-1}\). While in second year the highest yield was recorded in Suliman-96 and FD-91019 wheat varieties which was 2310 and 2232 kg ha\(^{-1}\) respectively (Hassan et al., 2003).

An experiment was planned to assess the yield stability of wheat and Maize in North China Plain at Luancheng Station. They found that increase in wheat yield was linked with the increase in grains per unit area without change of the weight of the grain. Number of grain per spike of winter wheat was increased from about 22 to 4243 kg ha\(^{-1}\) respectively. Maximum straw yield was also recorded in FD-91002 and Suliman-96 which was 6175 and 5760 kg ha\(^{-1}\). While in second year the highest yield was recorded in Suliman-96 and FD-91019 wheat varieties which was 2310 and 2232 kg ha\(^{-1}\) respectively (Zhang et al., 2005).

An experiment was conducted to check effect of different N levels on Bread wheat varieties. It was reported that among wheat varieties Daman-98 had maximum plant height, spike weight, grain spike\(^{-1}\), 1000-grain weight, biological yield and grain yield. Inqilab-91 had heavier grains and the most grain protein content, while Dera-98 had the maximum plant population and spikes m\(^{-2}\) (Iqtidaret al., 2006).

**Tillage × Variety**

Changes in tillage system to handle with the erosion problem of our soil are necessary to reconsider current management practices for annual wheat cropping systems. Near EI Reno a field experiment was conducted on fine mixed silt loam to find out growth response of ten wheat cultivars under conservation tillage in a continuous wheat cropping system. The cultivars were grown in moldboard-plowed seedbeds, and zero-tillage in standing stubbles of previous crop. The effects of tillage method on plant stand, phenology, grain yield, and yield components were determined. Tillage and cultivar interactions
varied with agronomic traits and years. Reducing tillage intensity delayed plant maturation beginning in the spring. Anthesis and leaf-area duration periods occurred about 1 to 8 days later in mulch-tilled and no-tilled plots, compared with plowed plots. The prolonged vegetative phase indicated a potential benefit of no-tillage in a wheat-production system that includes a livestock grazing component during the winter months. Grain-fill periods of no-tillage wheat increased between 1 to 4 days in early-maturity cultivars while those of later-maturity cultivars were variable. The yield of wheat in No-tillage was slightly better in years with cold autumns that had erosive rains or dry springs. Early maturity cultivars showed good results than late maturing cultivars in no-tillage system (Dao and Nguyen, 1989).

In India (Uttar Pradesh) a field experiment was planned during 1996-97 and 1997-98 to observe the effects of two tillage practices (zero tillage and conventional tillage) on ten wheat cultivars named as HS-277, HS-240, HD-2380, VL-616, VL-738, VL-719, VL-421, CPAN-1796, DT-46 and Local in rice-wheat cropping system. Under conventional tillage, after harvesting the rice, wheat was sown after field ploughing and applying irrigation before sowing. Under zero tillage wheat was sown by opening the furrows and irrigation was applied after 6 days of sowing. The effects of both tillage practices on the yield parameters such as plant height, days to heading, fertile tillers m⁻², and grains per spike and thousand grain weights of the wheat cultivars were calculated. Local, HD-2380, VL-738 and HS-277 had only 1.0, 3.2, 7.0 and 7.1% mean reductions, respectively, in grain yield under zero tillage compared to conventional tillage. Irrespective of cultivar, conventional tillage produced a 10-12.3% higher yield than zero tillage (Pandey et al., 2000).

It has been reported that in case of zero-tillage yield of wheat is greater than minimum tillage and conventional tillage. Zero-tillage can provide enough water for germination of wheat seed, ensure the provision of water moisture on long-term basis than heavy tilled field and also increase the tillering capacity of the wheat plant because of plenty of time is available for physiological process (Sayre and Ramos, 1997). An experiment was conducted with six conservation tillage and a conventional tillage treatment. Results from 6-years confirmed that the average water use efficiency in conventional tillage was 9% and in conservation tillage treatments was about 13% (Du et al.,2000). A twelve years study was conducted to see the effect of three tillage systems; conventional tillage (CT), minimum-tillage systems and zero-tillage (ZT) and three nitrogen fertilizer rates (35, 65 and 100 kg N ha⁻¹) on two wheat cultivars. The greatest 12-years average grain yield (1728 kg ha⁻¹) was obtained with ZT and use of 100 kg N ha⁻¹ (Halvorson and Black, 2000).

A field experiment was conducted at the Regional Wheat Research Center, Shyampur, Rajshahi during Rabi season of 2001-2002 and 2002-2003 to observe the performance of wheat genotypes among the different tillage options. There three tillage systems Bed planting, Zero tillage Conventional tillage. Within each tillage system, ten wheat genotypes were tested. From the results, it was observed that significant different between bed planting, zero tillage and conventional method of sowing was detected for plant population m⁻², grain yield, spike m⁻¹, spikelets spike⁻¹, grains spike⁻¹ and harvest index; but found non–significant for biomass, plant height and 1000 grain weight. Significantly higher grain yield was found in bed planting over zero tillage and conventional with Shatabdi variety. Higher harvest index was observed in bed planting over zero tillage and conventional with Shatabdi variety due to greater grain yield biomass ratio was attributed to the advantage of bed planting. The variety and method allowed plants to uptake more nutrients and moisture that contributed to higher grain yield through partitioning of photosynthesis to the grains. More ground cover (85%) was found in Shatabdi and BAW-1004 along with bed planting and lowest was (25%) from BAW-968 and Gourab along with conventional planting. Three weed species such as Chenopodium album, Cynodon dactylon and Cyperus rotundus were observed in the experimental plot. Maximum weed were found in conventionally treated plot at BAW-968 and Gourab due to their less ground cover percentage and minimum were Shatabdi and BAW-1004 genotypes with bed planting and in zero tillage due to more ground cover percentage. Chenopodium album was the highest infested weed in all the plots (Hossain et al., 2009).

Various tillage practices can overcome the delay sowing of wheat in the rice-wheat cropping system of Pakistan to sustain the grain yield by increasing the nutrients and water use efficiency. A field experiment was conducted to evaluate the effect of different tillage practices (zero tillage and conventional) on growth and yield of four wheat (Triticum aestivum L.) cultivars viz. Inqalab-91, Chenab-2000, Bhakkar-2002, and Iqbal-2002 under tropical conditions at the University of Agriculture Faisalabad, Punjab, Pakistan. Higher grain yield was recorded in zero tillage due to more number of tillers per unit area than the conventional tillage. The results obtained suggested adoption of zero-tillage practices for Pakistan and Inqalab-91 with the assurance of satisfactory yield production in rice-wheat cropping system in the tropical areas (Zamire et al., 2010).

A field experiment was carried out to determine the effect of tillage on yield of two wheat varieties sown after rice. This study was done on two wheat varieties (Sahar-2006 and Shafaq-2006) and four tillage practices (Zero Tillage, Minimum tillage, Conventional Tillage and Deep Tillage). Variety Sahar-2006 significantly produced more grain yield as compared to Shafaq-2006 with maximum grain yield obtained in Zero Tillage as compared to all other three tillage practice because of better germination count per unit area, higher plant height, longer spike length, more number of fertile tillers m⁻² and more number of grains spike⁻¹, heavier 1000-grain weight and larger biological yield. In addition to this, Zero Tillage was found to be the most economical practice in wheat sown after rice. It is therefore suggested that variety Sahar-2006 should be sown with ZT practice for better yield after harvest of rice (Husna et al., 2011).
Field experiments were conducted to determine the effects of tillage systems and varieties on growth, yield and quality of wheat crop (Triticum aestivum L.). The experiments were consist of three tillage practices, conventional tillage (CT), no-tillage (NT) and minimum tillage (MT) and four varieties (Siette, Panifor, Myrto, Estero). The soil porosity and total nitrogen were higher in soils subjected to conservation tillage systems (NT and MT) than under conventional tillage. There were no differences in root growth neither between the tillage systems nor among the varieties. Yield was influenced by the tillage system and variety. The highest grain yield (421.459 kg ha⁻¹) was found under the CT system with ‘Siette’, ‘Myrto’ and ‘Estero’ varieties. In contrast, the highest grain yield was observed under conservation tillage (NT and MT) with ‘Panifor’ variety. There were no significant differences between the tillage systems concerning the protein content (Bilaliset al., 2011).

Conclusion

Conservation tillage practices such as zero-tillage and minimum tillage increase grain yield due to better nutrients and water use efficiency, less soil erosion, less weed infestation, better crop establishment, high germination count per unit area and timely sowing of wheat crop in rice wheat cropping system areas. There were two hypotheses, innovative tillage system gives high yield and benefit, and newly evolved varieties of wheat can perform well in innovative tillage system in rice-wheat cropping system.

References


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