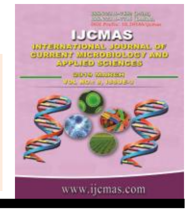
Int.J.Curr.Microbiol.App.Sci (2019) *8*(3): 2368-2375

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 8 Number 03 (2019)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2019.803.280

Effect of Tillage Practices and Moisture Regimes on the Performance of Growth, Yield and Nutrient Uptake of Timely Sown Wheat (*Triticum aestivum* L.)

Vinay Kumar Pandey*, B.N. Singh, Manoj Kumar, Shrimannarayan Dubey, Vipul Singh, Deepak Pandey and Ajit Kumar

Department of Agronomy, Narendra Deva University of Agricultural & Technology, Kumarganj, Faizabad, Uttar Pradesh-224229, India

**Corresponding author*

Keywords

Tillage practices, Moisture regimes, Growth, Yield, Nutrient uptake

Article Info

Accepted:
20 February 2019
Available Online:
10 March 2019

A B S T R A C T

The experiment was conducted during rabi season 2015-16 and 2016-17. The present investigation entitled "Effect of Tillage Practices and Moisture Regimes on the Performance of Wheat" was conducted at Agronomy Research Farm, of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj) Faizabad (U.P.). The experiment was laid out in split plot design having four tillage practices (zero tillage, reduced tillage+sowing by seed cum ferti drill, conventional tillage+sowing on beds and conventional tillage+ sowing by seed cum ferti drill) as main plot treatments and five moisture regimes (irrigation at 0.8 IW/CPE, irrigation at 1.0 IW/CPE and irrigation at 1.2 IW/CPE irrigation at 3 Irrigation each at CRI, Late jointing and Milking stage and 5 Irrigation each at CRI, Tillering, Late jointing, Flowering and Milking stage) as sub plot treatments. 20 treatment combinations were replicated three times. The result revealed that the growth, yield and nutrient uptake were recorded significantly higher in conventional tillage + sowing on bed, which was *at par* with conventional tillage+ sowing by seed cum ferti drill during both the years due to performance of tillage practices. However, the growth, yield and nutrient uptake were significantly higher under irrigation at 1.0 IW/CPE being *at par* with 1.2 IW/CPE ratio and 5 Irrigation each at CRI, tillering, late jointing, flowering and milking stage over rest of the treatments causes optimum availability of moisture at critical stage of the crop growth.

Introduction

Wheat (*Triticum aestivum* L.) is one of the most important cereal crop belong to the family Poaceae, in the world. In India wheat is the second most important food crop next to rice and it contributes nearly 35% to the national food basket. Among winter crops, it contributes about 49% of the food grains. In India, total area under wheat is 31.72 m ha with the production and productivity of 96.0 m tonnes and 3.13 tonnes ha^{-1}, respectively. It ranks first in the world among the cereals both in respect of area (225.07 m ha) and production (736.98 mt) (USDA, 2017). In India, total production of wheat crop was 86.53 mt from an covered area of 30.23 m ha during the recent past 2015-16 Rabi season and accounts for 38 per cent 4^{th} Advance Estimates. (Directorate of Economics and Statistics, Ministry of agriculture and farmers Welfare, India, 2016).Major wheat producing countries in the world are China, India USA, France, Russia, Canada, Australia, Pakistan, Turkey, UK, Argentina, Iran and Italy. These countries contribute about 76% of the total world wheat production. As far India is concerned, about 91% of the total wheat production is contributed by northern states. In India, the state wise production tops with of the Uttar Pradesh 26.87 mt, followed by Madhya Pradesh 17.69 mt, Punjab 16.08 mt, Haryana 11.35 mt, Rajasthan 9.87 mt, and Bihar 4.75 mt. These top six states together contributed about 93 per cent of the total wheat production.

Tillage is practiced in soils for controlling weeds, breaking crusts (improving water entry), increasing surface roughness (assisting water storage) and preparing a seedbed. The type of tillage method to be practiced, however, depends upon the soil type and the climate of the area (Coughlan *et al.,* 1989). Various techniques viz., zero-tillage (ZT) and bed planting have proved to be beneficial in terms of improving soil health, water use and crop productivity (Anonymous, 1995). ZT is widely adopted by farmers in the Northwestern Indo-Gangetic plain of India, particularly in areas where rice is harvested late (Bhushan *et al.,* 2007). It reduces irrigation requirements compared with conventional-tillage by using residual water more effectively (Erenstein *et al.,* 2007). Bed planting, another RCT, has benefits like reduced seed rate, rainwater conservation, mechanical weeding and less crop lodging (Gupta and Seth, 2007). Water is an important input for realizing high wheat productivity; however, it is becoming the most limiting factor for crop production in most of the north western parts of India (Hira, 2009). Irrigation water is a major constraint for assumed crop production. To grow wheat economically and successfully the evapo-transpirative demand must be balanced with supply of available to it. Proper scheduling of irrigation (amount and timing) is an important component of water saving techniques. There are numerous ways to schedule irrigations and estimate the required depth of water application Prihar *et al.,* 1997).

Materials and Methods

The present investigation entitled "Effect of Tillage Practices and Moisture Regimes on the Performance of Wheat" was carried at Agronomy Research Farm, of Narendra Deva University of Agriculture and Technology, Narendra Nagar Kumarganj, Faizabad (U.P.) out of during Rabi season, 2015-2016 and 2016-17. The experiment was constituted with 20 treatment involving four tillage practices in main plot and five irrigation levels in sub plot was laid out in split plot design with three replications. The experiment was laid out in given following *viz.,* tillage practices mention are: T_1-Zero tillage, T_2-Reduced tillage+sowing by seed cum ferti drill, T_3-Conventional tillage+ sowing on beds and T_4-Conventional tillage+ sowing by seed cum ferti drill as main plot treatment and five irrigation levels I_1-Irrigation at 0.8 IW/CPE, I_2-Irrigation at 1.0 IW/CPE, I_3-Irrigation at 1.2 IW/CPE, I_4-Irrigation each at CRI, Late jointing and Milking stage and I_5-5 Irrigation each at CRI, Tillering, Late jointing, Flowering and Milking stage as sub plot treatment. Wheat was sown on 15^{th} November during in both years (2015-16 and 2016-17) at with a row spacing of 20 cm with seed cum ferti drill. Recommended dose of fertilizer N:P:K 120:60:40 kg ha^{-1} gave in crop. Uniform dose of nitrogen 60 kg ha^{-1} through urea, phosphorus @ 60 kg ha^{-1} through di-ammonium phosphate and potassium @ 40 kg ha^{-1} through muriate of potash 60% (K_2O) were applied to all treatments as basal dressing. Remaining half and 1/3 quantity of nitrogen was top dressed at CRI and tillering stage. Experimental field was slit loam in texture with low organic carbon (0.381 0. 0.421 %), low nitrogen (160.27 and 165.53 kg ha^{-1}), and medium in phosphorus (16.83 and 17.78 kg ha^{-1}) and high range in potassium (258.57 and 265.27 kg ha^{-1}).

The variety was sown PBW-502. Ii is widely adopted in the area NWPZ. This variety may be grown in Entire North East India of India. It gives an average yield of 46-50 q ha^{-1}. Effective tillers were observed in running meter, and then converted values in square meter. The straw yield was computed by deducting the grain yield from the total biological yield and the grain yield data were adjusted at 14% moisture content. Statistical significance between mean differences among the treatment for different parameter was analyzed using the critical differences (CD) at 0.05 % probability level.

Results and Discussion

The experimental results presented in the previous chapter contained the detailed information on study entitled "Effect of Tillage Practices and Moisture Regimes on the Performance of Wheat." to find out the suitable tillage practice and moisture regime for wheat production given following result and discussion below:

Effect of tillage practices on growth and yield

Initial plant population taken at 15 days after sowing was not influenced due to tillage practices. It was possibly due to favorable and similar soil and moisture condition for germination of seed in all treatments. This was mainly due to the fact that initial plant population was conducted at 15 DAS and irrigation treatments were not applied up-to this period.

Maximum initial plant population was recorded 133.35 and 134.14 plants m^{-2} in conventional tillage + sowing on beds (T_3) which was *at par* with conventional tillage+ sowing by seed cum ferti drill (T_4) and reduced tillage + sowing by seed cum ferti drill (T_2) respectively. Maximum plant height (cm), number of shoots m^{-2} and dry matter accumulation (gm m^{-2}) at harvest stage significant was recorded treatment under conventional tillage + sowing on beds (T_3) which was *at par* with conventional tillage+ sowing by seed cum ferti drill (T_4) and reduced tillage + sowing by seed cum ferti drill (T_2) respectively, during both the years.

However, the lowest all the parameters were recorded under treatments zero tillage (T_1) (Khatri *et al.,* 2002; Ishaq and Ibrahim, 2003; and Naresh *et al.,* 2012). Number of shoots m^{-2}were not affected significantly due to different tillage practices at all the stages of crop growth. It increased progressively up- to 90^{th}days stage and thereafter, decreased at harvest (Wiatrak *et al.,* 2004; Naresh *et al.,* 2004; Ram Pravash, 2007; Naresh *et al.,* 2012). This finding is supported by Pratik *et al.,* (2002), Srivastva *et al.,* (2002) Kumar *et al.,* (2005), Prasad *et al.,* (2005).

However, the highest grain yield, straw yield (q ha^{-1}), and harvest index (%) was observed under conventional tillage + sowing on beds (T_3) which was being *at par* with conventional tillage + sowing by seed cum ferti drill (T_4) 43.90 and 44.61 q ha^{-1} and reduced tillage + sowing by seed cum ferti drill (T_2) 42.64 and 43.33 q ha^{-1}during both the years respectively. Similar research findings were also reported by Avtar *et al.,* (2002), Asefa *et al.,* (2004) Prasad *et al., (*2010) and Dhuka *et al.,* (1992) (Table 1 and 2).

Table.1 Effect of Tillage practices and moisture regime on growth, yield attributes and yield of wheat

Treatment	Innitial plant population (m^{-2})		Plant height (cm) At harvest		Number of shoots (m^{-2}) At harvest stage		Dry matter accumulation (g m^{-2}) At harvest		Grain yield (q ha^{-1})		Straw yield (q ha^{-1})		Harvest index (%)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Factor A: Tillage practices (Main plot)														
T_1	122.20	122.97	87.84	89.55	359.96	364.17	941.14	951.72	39.45	40.44	54.79	55.31	41.83	42.16
T_2	125.30	126.16	95.15	97.02	395.56	398.44	1019.51	1031.05	42.64	43.33	58.66	59.10	42.09	42.30
T_3-	133.35	134.14	101.51	103.50	423.02	423.25	1087.63	1100.00	46.00	46.74	62.08	62.45	42.55	42.83
T_4	128.28	128.68	97.61	99.53	404.60	407.43	1045.86	1057.72	43.90	44.61	59.98	60.56	42.27	42.39
SEm ±	2.28	2.59	1.80	1.84	7.57	7.66	19.66	19.56	1.10	1.03	1.51	1.49	-	-
CD at 5%	NS	NS	6.25	6.37	26.19	26.51	68.03	67.69	3.81	3.58	5.24	5.16	-	-
Factor B:Moisture regimes (Sub plot)														
I_1	126.97	127.89	92.65	94.46	381.69	387.72	992.67	1003.88	40.27	41.20	55.63	56.45	41.98	42.17
I_2	128.14	129.34	100.40	102.37	418.08	421.04	1075.71	1087.95	46.20	47.11	61.65	61.96	42.85	43.21
I_3	127.34	128.04	100.01	101.98	417.11	416.33	1071.61	1083.77	45.48	45.97	61.64	61.82	42.46	42.64
I_4	125.97	126.64	86.56	88.25	354.15	357.65	927.51	937.91	38.50	39.01	54.49	54.73	41.40	41.61
I_5	127.26	128.00	98.01	99.94	408.01	408.77	1050.18	1062.10	44.53	45.60	60.97	61.81	42.23	42.47
SEm ±	2.31	2.28	1.68	1.72	7.06	7.09	18.24	18.25	0.72	0.75	1.01	1.02	-	-
CD at 5%	NS	NS	4.92	5.01	20.61	20.69	53.24	53.27	2.094	2.20	2.95	2.97	-	-

Table.2 Effect of tillage practices and moisture regime on nitrogen uptake, phosphorous and potassium uptake in grains, straw (kg ha^{-1}) crop of wheat

Treatments	Nitrogen uptake (kg ha^{-1})				Phosphorous uptake (kg ha^{-1})				Potassium uptake (kg ha^{-1})			
	Grains		Straw		Grains		Straw		Grains		Straw	
	15-16	16-17	15-16	16-17	15-16	16-17	15-16	16-17	15-16	16-17	15-16	16-17
Factor A: Tillage practices (Main plot)												
T_1	60.03	61.59	28.52	28.80	14.07	14.68	6.46	6.84	13.68	14.29	76.97	78.20
T_2	66.00	67.12	31.06	31.27	15.77	16.46	7.03	7.43	15.33	16.01	83.74	85.02
T_3	72.04	73.20	33.23	33.40	17.19	17.95	7.52	7.95	16.73	17.47	89.67	90.77
T_4	68.20	69.27	31.90	32.19	16.29	16.99	7.22	7.65	15.84	16.54	86.01	87.43
SEm ±	2.032	1.794	0.92	0.89	0.44	0.45	0.22	0.19	0.36	0.34	2.26	2.15
CD at 5%	7.03	6.21	3.17	3.09	1.51	1.55	0.77	0.68	1.26	1.17	7.82	7.47
Factor B:Moisture regimes (Sub plot)												
I_1	62.35	63.80	29.45	29.85	14.90	15.64	6.67	14.90	14.46	15.22	79.45	81.12
I_2	72.64	74.03	33.15	33.32	17.21	17.90	7.50	17.21	16.75	17.43	89.42	90.53
I_3	71.07	71.94	32.98	33.06	16.99	17.65	7.47	16.99	16.52	17.18	88.98	89.83
I_4	58.50	59.27	28.33	28.42	13.86	14.42	6.41	13.86	13.48	14.04	76.39	77.26
I_5	68.28	69.94	31.97	32.41	16.19	16.98	7.24	16.19	15.75	16.52	86.24	88.04
SEm ±	1.10	1.36	0.68	0.56	0.33	0.35	0.14	0.33	0.26	0.32	1.75	1.69
CD at 5%	3.21	3.98	2.00	1.65	0.97	1.03	0.40	0.97	0.77	0.93	5.12	4.93

Effect of tillage practices on nutrient uptake

The highest nitrogen, phosphorous and potassium uptake kg ha^{-1}, was recoded under conventional tillage + sowing on beds (T_3) in grains, straw which was being *at par* with conventional tillage + sowing by seed cum ferti drill (T_4) and reduced tillage + sowing by seed cum ferti drill (T_2), respectively. Although, the lowest nitrogen uptake in grains, straw grains, straw was recorded under zero tollage (T_1) during both of the years of investigation (Singh *et al.,* 1975; Singh and Seath, 1978; Singh and Seath, 1978 and Dighe *et al.,* 1978).

Effect of moisture regimes on growth and yield

Various levels of moisture regimes affected the growth of wheat *i.e.* plant population plants m^{-2}, plant height (cm) at harvest stage, Number of shoots m^{-2} at harvest stage and dry matter accumulation (gm m^{-2}) at harvest stage significant was recorded under treatment 1.0 IW/CPE (I_2) which *at par* with 1.2 IW/CPE and 5 irrigation each at CRI, tillering, late jointing, flowering and milking stage (I_5) respectively. Though, the minimum were observed with 3 irrigation each at CRI, late jointing and milking stage (I_4) during both the years 2015-16 and 2016-17 respectively. This might be due to increase in plant height, and uptake of nutrients through adequate irrigation supply. All these contributed for full turgidity and opened leaves, which increased the photosynthetic activity of crops, resulting in higher dry matter accumulation (Rahman *et al.,* 2000; Saren *et al.,* 2004). Similar trend was found also reported by Rahman *et al.,* (2002), Prashar and Thaman (2005), Khatri *et al.,* (2002).

Highest grain yield, straw yield (q ha^{-1}) was recorded under irrigation at 1.0 IW/CPE (I_4) which *at par* with 1.2 IW/CPE (I_3) and 5 irrigation each at CRI, tillering, late jointing, flowering and milking stage (I_5) respectively. This might be due to adequate moisture availability, which contributed to better growth parameter and yield attributes. The finding is supported by Khatri *et al.,* (2002). Similar research findings were also reported by Nadeem *et al.,* (2007) and Behera and Sharma (2014).

Effect of moisture regimes on nutrient uptake

The highest nitrogen, phosphorous and potassium uptake (kg ha^{-1}) was recorded in 1.0 IW/CPE ratio (I_2) in grains, straw which being *at par* with (I_3) and 5 irrigation each at CRI, tillering, late jointing, flowering and milking stage (I_5) moisture regime while the lowest nitrogen uptake was observed under the 3 irrigation each at CRI, late jointing and milking stage (I_4) during both the years of investigation.

On the basis of experimental findings, it can be concluded that the conventional tillage + sowing on beds (T_3) provide suitable to be better for growth and development, yield and nutrient uptake of timely sown wheat. Thus, the irrigation scheduling at moisture regime under the treatment 1.0 IW/CPE (I_2) (6 irrigations) seem to provide for suitable and adequate moisture supply to be better growth, photosynthetic activity, development, yield and uptake of nutrients through adequate irrigation supply in wheat.

References

Anonymous. (1995). Tillage Systems in Tropics: Management Options and Sustainability Implications, in: R. Lal (Ed.), FAO. *Soils Bulletin,* 71: 107–120.

Asefa, T., Tanner, D. and Bennie, A.T.P. (2004). Effects of stubble management, tillage and cropping sequence on wheat production in the south-eastern highlands of Ethopia. *Soil and Tillage Research*, 76(1): 69-82.

Avtar; Mahey, R. K., Singh, O., Brar, S. S., Virk, A. S. and Singh, J. 2002. Effect of first, subsequent irrigation (s) and tillage on grain yield, nutrients uptake, rooting density of wheat, soil moisture content, consumptive use and water use efficiency. *Res. on Crops*, 3(1): 1-10.

Behera, U. K. and Sharma, A.R. 2014. Productivity and water use efficiency of wheat (*Triticum aestivum*) under different resource conservation techniques and irrigation regimes. *Cereal Res. Communications*, 42(3): 439-449.

Bhushan, L., Ladha, J.K., Gupta, R.K., Singh, S., Tirol-Padre A., Saharawat, Y.S., Gathala, M. and Pathak, H. 2007. Saving of water and labor in a rice–wheat system with no tillage and direct seeding technologies. *Agronomy Journal* 99: 1288–1296.

Coughlan, K.J., Smith, G.D., and Yule, D.F. 1989. Soil physical research for improved dry land crop production in Vertisols in Queensland, Australia. In: In Management of Vertisols for improved agricultural production. Proceeding of an IBSRAM Inaugural Workshop, ICRISAT, India. Pp. 18-22.

Dhuka, A.K., Sadaria, S.G., Patel, J.G. and Patel, B.S. 1992. Effect of rate and time of N application on late sown wheat. Indian J. Agron., 37 (2): 354-55.

Directorate of Economics and Statistics, Ministry of agriculture and farmers Welfare, India, 2016.

Gupta, R.K and Seth, A. 2007. A review of resource conservation technologies for sustainable management of the rice-wheat system cropping systems of the Indo- Gangetic Plains. *Crop Protection* 26: 436-447.

Hira, G.S. 2009. Water management in northern states and the food security of India. Journal of Crop Improvement 23: 136–157.

Idnani, L. K. and Kumar, A. 2012. Relative efficiency of different.; irrigation schedules for conventional, ridge and raised bed seeding of wheat (*Triticum aestivum*). *Indian J. of Agro.*, 57(2): 148-151.

Ishaq, M., Ibrahim, M. and Lal, R. 2003. Tillage and fertilizers effects on root growth of wheat and cotton on a sandy loam in Pakistan. *Journal of Sustainable Agriculture*, 22(1): 167-176.

Jackson, M.L. 1967. Soil chemical analysis. Prentice hall of India, Private Limited, New Delhi, Pp. 183.

Khatri, R. S., Goel, A. C. and Malik, R. K. 2001. Consumptive use and soil moisture depletion pattern in bed and flat sowing ofwheat in rice-wheat system under different irrigation levels. *Inte. J. Tropical Agri.*, 18(3): 259-264.

Nadeem, M. A., Tanveer, A., Ali, A., Ayub, M. and Tahir, M. 2007. Effect of weed-control practice and irrigation levels on weeds and yield of wheat (*Triticum aestivum*). Indian J. of Agro., 52(1): 60-63.

Naresh, R. K., Singh, B., Singh, S. P., Singh, P. K., Arvind Kumar and Amit Kumar, 2012. Furrow Irrigated Raised Bed (FIRB) planting technique for diversification of rice-wheat system for Western IGP region. *International Journal of Life Sciences Biotechnology and Pharma Res.*, 1(3):134-141.

Naresh, R.K., Singh, S.P., Dwivedi, Ashish, Sepat, Naval Kishor, Kumar, Vineet., Kumar, Ronaliya Lalit., Kumar, Vikas and Singh, Rachna. 2013. Conservation Agriculture improving soil quality for sustainable production systems under smallholder farming conditions in North West India: A Review. *International*

Journal of Sciences of Life Sciences Biotechnology and Pharma Research 2(4): 151-213.

Olsen, S.R., Cok, C.V., Watanabe, P.C. and Dean, L.A. 1954. Estimation of phosphorus in soils by extraction with di-sodium carbonate. U.S.D.A. circular. 34, 939, 1-19 U.S. Government Printing Office, Washington D.C.

Prasad, S., Singh, Y., Singh, R.P. and Singh, G. 2005. Effect of crop establishment, weed control method and time of nitrogen application on late-sown wheat. Indian journal of weed science 37(1, 2): 93-95.

Pratik; Satya; Chowdhury, S and Tomar, S. M. S. 2002. Path coefficient analysis of agronomic characters affecting grain yield in wheat (*Triticum aestivum* L.) under furrow-irrigated raised bed (FIRB) planting system. *Annals of Agri. Res.*, 23(2): 248-255.

Prihar, S.S. and Khepar, S.D. 1997. Resource management for sustainable intensive agriculture– water. Proc. Third Agricultural Science Congress, National Academy of Agricultural Sciences, Ludhiana, Punjab. Pp. 91–101.

Rehman, M.A., Karim, A.J.M.S., Haque, M.M. and Eqashira, K. 2000. Effect of irrigation and nitrogen fertilization on plant growth and root characteristics of wheat on a clay terrace soil of Bangladesh. *J. Faculty of Agric.* 45 (1): 301-308.

Singh, R.P. and Seth, J. 1978. Nitrogen uptake and potential of production dry matter in dwarf wheat as influenced by soil and foliar application of nitrogen, Indian J. Agric., Sci., 48 (6): 342-46.

Subbaih B.V and Asija G. L. 1956. A rapid procedure for determination of available nitrogen in soil. Current Sci., 25: 259-260.

USDA, 2017. World Agriculture Production. Pp: 1-30.

Wiatrak, P.J., Wright, D.L. and Marois. 2004. Tillage and residual nitrogen impact on wheat forage. *Agronomy journal* 96 (6): 1761-1764.

How to cite this article:

Vinay Kumar Pandey, B.N. Singh, Manoj Kumar, Shrimannarayan Dubey, Vipul Singh, Deepak Pandey and Ajit Kumar. 2019. Effect of Tillage Practices and Moisture Regimes on the Performance of Growth, Yield and Nutrient Uptake of Timely Sown Wheat (*Triticum aestivum* L.). *Int.J.Curr.Microbiol.App.Sci.* 8(03): 2368-2375.
doi: https://doi.org/10.20546/ijcmas.2019.803.280