Cultivation of wheat under wheat intensification system in central plain zone of Punjab

Pankush Tagra and Vandna Chhabra*

Lovely Professional University,

Phagwara-144411, Punjab, India.

ABSTRACT

System of Wheat Intensification (SWI) is a new concept and technique for cultivation of wheat under conditions of resources scarcity for marginal farmers of the country. The technique registered saving of seeds, water, nutrients, labour, pesticides and time also, but not at the cost of grain yield and monetary benefits. In future time periods with vagaries of climate change, it may be proved to be one of the best climate smart technologies and alternative strategies to save precious land and water resources for food security in future.

INTRODUCTION

Wheat is most widely cultivated food crop and in world standing second in grain production (Meena and Singh, 2013; DWR, 2012). Wheat is grown in winter season from October to December and mainly harvesting is done during February to May. For the perfect growth of crop, climate of cool winters to hot summers is required. In Punjab, the major crop rotation of wheat and rice are followed season by season. The traditional method for sowing of wheat is broadcasting and for rice is transplanting. In traditional method more seed rate, fertilizers rate, amount of water to grow are needed and competition of crop with weeds is pronounced.

In present times, the availability of resources is decreasing day by day as these are exploited more than capability, thus can adversely affect agricultural production in future. So adoption of techniques like drip irrigation, sprinkler irrigation, raised bed planting, bidirectional sowing, cultivation of drought resistant varieties and organic farming are advocated. So, a new concept or technique known as a system of wheat intensification (SWI) may be adopted for doubling the yield of marginal farmers. This method conserves our natural resources and can prove to be a pathway safe for environment and biotic communities in future changing climatic scenarios. Weeds can be controlled in a better way by maintaining proper spacing, with lesser seed rate.

SWI was well suited to the small scale farmers in Bihar (Uphoff *et.al*, 2011). They used this technique in both seasons, during kharif, system of rice intensification and in winter system of wheat intensification. By using the lower seed rate good yield was reported. Less irrigation was required in the method to maintain the soil nutrients and made soil more friable (Dhar *et al*., 2014) and high output was obtained at lesser cost of cultivation. The NGO, Jeevika got good results in Bihar state and 30,000 farmers used SWI methods since

2009-2010 (PRADAN, 2012). SWI method gave higher grain yield than broadcasting method under both un-irrigated and irrigated condition for wheat (Chopra and Sen, 2013).

SWI reported to be labour saving with farm mechanization (Satyanarayana *et al*., 2007). Styger and Ibrahim (2009) observed 80-90% lesser seed and 30% less chemicals by adoption of crop intensification technique. Khadka (2013) observed that wheat var. WK 1204 produced 2 times more yield by applying SRI principles. Rana *et al*., 2017 reported better performance of SWI as compared to traditional method of wheat establishment. By keeping in view the encouraging results, this study is conducted.

Material and Methodology

A field trial on wheat crop (Var.PBW-343) was conducted at the farm of Lovely Professional University, which falls under Trans-gangetic plains region of agro climatic zone of Punjab during *rabi*, 2018-19. Seven treatments were replicated thrice in randomized block design. Seed priming was done by using the materials like cow urine and fungicide and seeds without priming were also sown by broadcasting and line sowing methods along with recommended dose or 75% of RDF (Recommended dose of fertilizers).

Results and Discussion

Growth and yield attributes in wheat

Plant height (cm)

Highest plant height (96.4 cm) was observed when wheat seeds were primed with cow urine and sowing is done in lines applied with RDF (T5) followed by plant height (92.2 cm) in plots where fungicide treated seeds were sown by line sowing method (T4) at harvest stage. Treatments viz. T4 and T7 remained statistically at par with each other in terms of plant height, similar is the case for T2 and T6 as presented in table 1. Maximum deviation of plant height from control plot is 23% in T5 followed by 15% in T7 treatments. That means seeds treated with cow urine with line sowing method and applied with either 75% or 100% NPK produced better height in plants as compared to other treatments.

Number of tillers plant^{-1}

Maximum tiller count was observed highest (9.5) and statistically same in line sown seeds primed seeds either by cow urine or fungicide and applied with recommended fertilizers' dose, however, it was followed by T7 (Primed seeds with cow urine+75% RDF). Almost 5% lesser number of tillers was noticed by application of 25% reduced dose of fertilizers even in line sown wheat. While by comparing both methods viz. broadcasting and line sowing without seed priming, more tillers were obtained in line sowing (T2) compared to T1 may be due to proper plant density and optimum availability of solar radiations, water and nutrients to the plants.

Table-1 Plant height and number of tillers per plant in wheat at harvest

Treatments		Plant height (cm)	% change from control	Number of tillers plant^{-1}	% change from control
T0	Control (Broadcasting)	78.3	-	5.5	-
T1	Broadcasting+ 100% NPK	77.4	-1.1	6.1	10.9
T2	Line Sowing+ 100% NPK	83.6	6.8	6.4	16.4
T3	Line Sowing+75% NPK	78.1	-0.3	5.2	-5.5
T4	Primed seed (Fungicide)+Line Sowing+ 100% NPK	92.2	17.8	9.5	72.7
T5	Primed seed (Cow urine)+Line Sowing+ 100% NPK	96.4	23.1	9.5	72.7
T6	Primed seed (Fungicide) +Line Sowing+75% NPK	83.5	6.6	8.1	47.3
T7	Primed seed(Cow urine)+Line Sowing+75% NPK	90.2	15.2	8.9	61.8

Test weight (g)

Maximum test weight (4.5 g) was observed in T5 followed by T4 with 4.3 g and T7 with 4.0 g test weight. Least test weight was found in control treatment, though it was statistically at par with T2 and T3 treatments (Fig 1). Similar is the case of number of grains per spike, here maximum grain number per spike was in T5 followed by T4 and T7 (Fig 2).

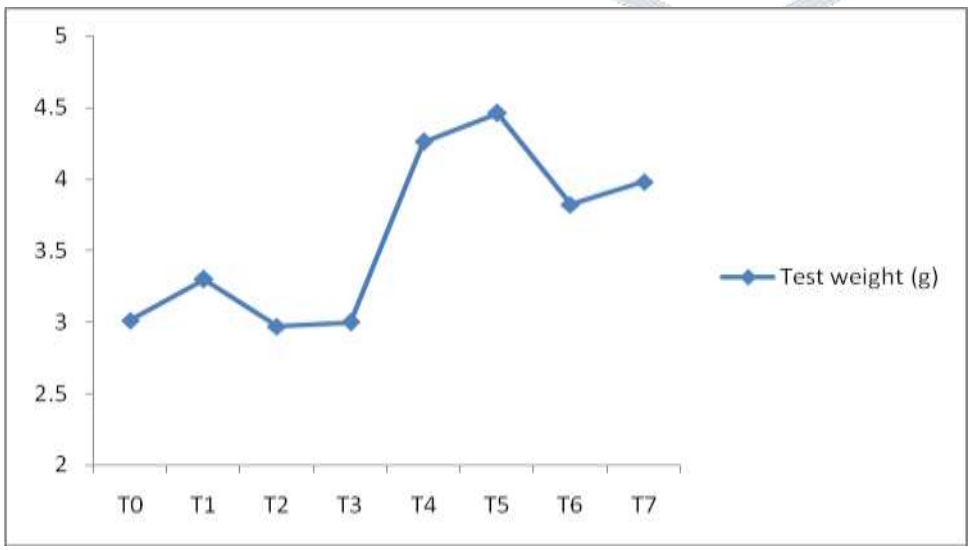

Fig 1. Test weight (g) of wheat during 2018-19

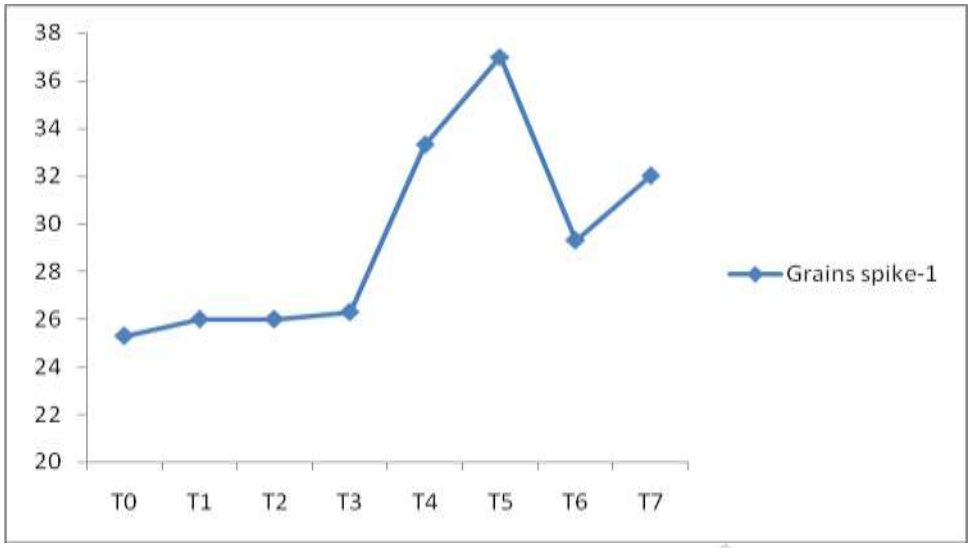

Fig 2. Number of grains spike^{-1} of wheat during 2018-19

Grain yield (q ha^{-1})

Grain yield in wheat was found highest (31.3 q ha^{-1}) when cow urine primed seeds were sown in lines by applying recommended dose of fertilizers (T5) followed by T7 (cow urine + line sowing+75% RDF) with 14% lesser yield. Though test weight and grain number per spike were second highest in T4 but more number of spikes, higher spike length and biomass in T7 may contributed to more grain yield (about 6%) in T7 compared to T4 (Fig 3). This may be due to presence of almost 1% nitrogen and potassium and other antimicrobial properties of cow urine (Yawalker *et al*., 1996). These results are corroborated with Tagore *et al*., 2017, who noticed higher seed yield and quality parameters of clusterbean when treated with cow urine. Higher wheat grain and straw yield was observed by Shivamurthy, 2005 by using 10% cow urine for seed treatment.

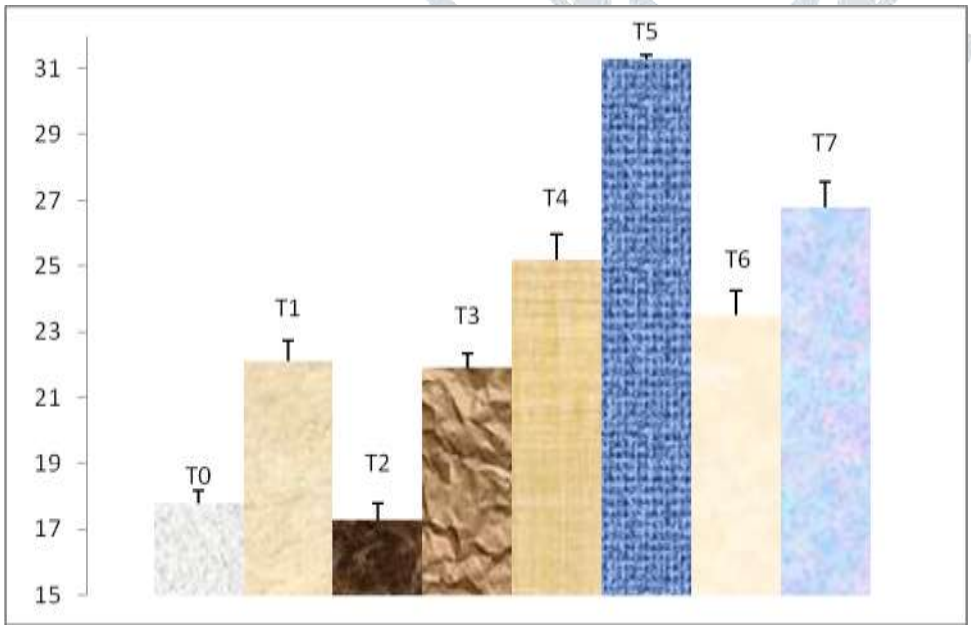

Fig 3. Grain yield (q ha^{-1}) in wheat crop during 2018-19

REFERENCES

Chopra, R., & Sen, D. (2013). Golden wheat becomes more golden: Extending SRI to wheat. *LEISA India*, *15*, 30-32.

Dhar, S., Barah, B.C. and Vyas, A.K. (2014). Comparative performance of System of Wheat Intensification (SWI) and other methods of wheat cultivation in north western plain zone of India. In: International SRI Research seminar on recent Changes in Rice Production and Rural Livelihoods: New Insights on the System of Rice Intensification (SRI) as a Socio-Technical Movement in India. Indian Agricultural Research Institute, New Delhi. Available at URL: http://www.sri-india.net/event2014/research.htm#Abstract_7(Accessed 12thMarch, 2015).

Dobermann, A. (2004). A critical assessment of the system of rice intensification (SRI). *Agric. Sys.,* 79,261-281.

DWR. (2012). Progress Report, All India Coordinated Wheat & Barley Improvement Project, Directorate of Wheat Research, Karnal, 4.

Kaur, R., Mahey, R.K. and Kingra, P.K. (2012). Effect of population density of Phalaris minor on production potential of wheat (Triticum aestivum). *Indian J. Agron.*,57: 157-161.

Khadka, R.B. (2013). System of Wheat Intensification (SWI)-A New Technology for Wheat Intensification Practiced in Kailali Nepal. Presentation by Ram B. Khadka,Programme Coordinator, European Union Food Facility, FAYA-Nepal, Dhangadhi, Kailali, Nepal. 10 slides. Available at URL:http://www.slideshare.net/SRI.CORNELL/1304-system-of-wheat-intensification-in-kailali-nepal-swi(Accessed 21thJanuary, 2015).

McDonald, A.J., Hobbs, P.R. and Riha, S.J. (2006). Does this system of rice intensification outperform conventional best management? A synopsis of the empirical record. *Field Crops Res.,* 96, 31-36.

Meena, B.L. and Singh,R.K. (2013). Response of wheat (Triticum aestivum) to rice (Oryza sativa) residue and weed management practices. Indian J. Agron., 58, 521-524.

PRADAN. (2012). Cultivating wheat with SRI Principles: A manual. System of Rice Intensification website.

Rana, L.,Hirak Banerjee, Krishnendu Rayand Sukamal Sarkar. System of Wheat Intensification (SWI)-a new approach for increasing wheat yield in small holder farming system. *Journal of Applied and Natural Science*, 9(3), 1453-1464.

Satyanarayana, A., Thiyagarajan, T.M., Uphoff, N. (2007). Opportunities for water saving with higher yield from the system of rice intensification. *Irrig. Sci*.,25, 99-115.

Shivamurthy D (2005). Effects of method of planting and seed treatments on performance of wheat genotypes under rainfed condition. M.Sc.Thesis. Department of Agronomy, College of Agriculture, Dharwad, University of Agricultural Sciences, Dharwad, Karnataka, India

Styger, E. and Ibrahim, H. (2009). The System of Wheat Intensification (SWI): Initial Test by Farmers in Goundam and Dire, Timbuktu, Mali, Africare, Mali, Bamako Available at URL:http://ciifad.cornell.edu/sri/countries/mali/MaliSWIrpt071309.pdf (Accessed 23th January, 2015).

Tagore, B. Shankar, A and Teresa, S. (2017). Effect of organic seed priming with cow urine at different concentrations. *Advanced Journal of Agricultural Research*, 4 (9), 168-171.

Uphoff, N., Kassam, A. and Harwood, R. (2011). SRI as a methodology for raising crop and water productivity: productive adaptations in rice agronomy and irrigation water management. *Paddy Water Environ.*, 9, 3-11.

Yawalkar, K. S., J. P. Agarwal and S. Bokde. (1996). Manures and Fertilizers, Agri-Horticultural Publishing House, Nagpur: pp. 29-82.