Article

System of wheat intensification (SWI)

An Innovative approach for increasing wheat production in natural farming system

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System of wheat intensification (SWI) is a progressive wheat establishment approach regarding additives of wheat cultivation practices inclusive of sowing, weeding, irrigation, and nutrient control. These control practices offer better conditions for an increase of wheat crops withinside the root zone than the plants grown below conventional wheat cultivation practices It can also additionally allow the crop to face up to biotic and abiotic stresses which might be turning into greater extreme with climate change. The adoption of SWI can increase the productivity and income of resource-poor farmers by saving agro-inputs. It can lessen weeding time to one-third and to one-half of the time needed for current weeding practice. Herbicide use is effective with SWI, however, farmers are inventing or modifying tools that reduce the labor time required for weeding. Thus, SWI is a technique aimed toward growing the yield of wheat, in which all agronomic principles are placed into practice to offer high wheat yield per drop of water and per kg of agricultural inputs like fertilizer, seed, etc.

What is system of wheat intensification

The era which has excessive potential to provide excessive wheat yield per drop of water per kg of agricultural inputs (fertilizer, seed, etc.) and application of different SRI principles to the wheat crop, is referred to as the system of wheat intensification (Dhar et al.,2014). Adoption of this era can increase the productivity of wheat by more than 2 times (Uphoff et al., 2011). Lead SRI researchers (Sheehy et al., 2004) are spearheading new studies on applying SRI techniques to wheat cultivation in China and Madagascar. SWI is an innovative wheat establishment technique involving components of wheat cultivation practices such as sowing, weeding, irrigation, and nutrient management. These management practices provide better condition of growth for wheat crop in the root zone than those plants grown under conventional wheat cultivation practices.

Principles of SWI

SWI is based totally on following standards of crop production.

1. Principle of root development.
2. Principle of intensive care.

Principle of root development

For proper development of crop plant, it must be well established from rooting system. Root development is the first stage of healthy growth and development of any plant. It requires proper nourishment and sufficient

space around the plant. Their root system is not so developed, and the effect was evident on tillering capacity (reduced by 41.6%) and biomass yield (60-65% loss) in Lahore (Pakistan), as mentioned by Anjuman and Bajwa (2010). But withinside the case of SWI, plants are spaced wide (20 cm from each other) and usually in a square pattern. As SWI practice enhance the soil over time, wider spacing (20 cm × 20 cm) can later give even better yields.

Principle of intensive case

Intensification does not mean high number of plant density per unit space; rather it is proper space maintenance and taking care of plants very closely. To enhance productivity, it requires intensive care in every stage of plant growth specially management of weed, insect, disease, organic manure and irrigation.

Aims of basic principles

- Efficient water management.
- Weeding by mechanical weeder.
- Use organic matter/manures.
- Crop rotation with green manuring crops.
- Wider and sufficient spacing.
- Crop residue management.
- Improve soil health

Package of practices for SWI

In SWI, the fundamental practices of wheat cultivation more or less remain same; however, it creates conducive environment for crop through changes in sowing geometry weed management and a stressing on organic manuring.

It aims to increase the crop production while enhancing the intrinsic productivity of land, with minimum use of external inputs.

Land selection and preparation

Well drained, loamy fertile soil with pH ranging 6.0 to 8.5 is considered idea for cultivation of wheat. Avoid water logged soils and select land with which is having adequate drainage facility for removing of excess water.

The ploughing is required for obtaining good tilth for wheat sowing in SWI. The first ploughing is done to remove roots of preceding crops cultivated on the land. After 1to 1.5-month compost is applied and land ploughed for the second time. Last ploughing is carried out before sowing of wheat seeds.

Manure application

A good wheat required adequate amount of Nitrogen, Phosphorus, Potash proper proportion, 80-125:40-60:30-40 kg/ha. Soil test-based nutrient has been recommended followed by the application of organic manures such as FYM, Vermicompost,

NADEP compost, liquid manure like (Sanjivak, Jivamrut, Amritpani, Panchgavya, Dashagavya) and other manures (including crop residue and animal dung are commonly used for this purpose).

Seed selection and treatment

25 kg/ha bold and healthy wheat seeds are taken by putting seeds in solution of 20% salt in water and removal of floating seeds. Thus, for seed treatment a mixture of 10 L warm water (60°C), 2kg well- decomposed compost or vermicompost, 3 litres of cow urine and 2 Kg of jaggery prepared in an earthen pot. After mixing it properly, 5 Kg seeds dipped in the mixture and left for 6-8 hours. With the same ratio of the above ingredient, the mixture for may be prepared for more amount of seed for treatment. The next step is to separate seeds from mixture by filter and washing with clean water. Treated seeds is kept in shade for 10-12 hours and by this time seeds fully sprout.

Sowing

The sprouted seeds will be used for sowing in the field by dibbling using two seeds per hill. Different row to row and plant to plant spacing (15cm X 15cm or 20cm X 20cm) can be used depending on the moisture content. A manually driven or motorized seed drill can be used for sowing. If seed drill is not available then the fields are marked by using rope or a string tagged at 15/20 cm intervals. Seeds will be sown at a depth of 2.5-3.0 cm using a dibbler or pegs. Sufficient moisture should be provided in the soil while sowing germinated seed. Wherever the seed failed to germinate or destroyed, the gaps were filled with germinated seeds within 10 days of sowing. Extra seeds germinated in a hill have removed to reduce competition.

Weed management

Hoeing is an important component of SWI because it ruins the weeds that compete with crops for space, light, water, and nutrients. Weeding through hoeing loosens the soils and effectively aerates the roots, permitting exploration of soil that leads to better water and vitamin absorption from deeper soil depth. The weeds are Incorporated into the soils which enables in increasing water holding capacity and nutrients status of the soil. In SWI normally weeding at 20-25 days

after sowing (DAS). Subsequent weeding is carried out in intervals of 10 days.

Water Management

In SWI, the soil is kept alternately moist and dry, and 3-5 irrigations can be given per soil moisture status. First irrigation is given at 15 DAS, earlier than the crown root initiation (CRI). A second irrigation will be given after 40 DAS at the soil develops hairline cracks. Irrigations are given before weeding in the early stages of crop growth. A third irrigation was given at 75 DAS. Fourth irrigation was given at flowering and fifth irrigation at the grain-filling stage.

Advantage of SWI

SWI exercise constructively reduces the capital, fertilizer, labor, and water inputs while increasing crop yields. Further, this technique promotes extra abundance, diversity, and pastime of soil biota in and across the rhizosphere region of the plant. These modified practices with reduced inputs, supported through good aeration and organic matter for the soil, resulted in the general improvement of crop productivity.

Direct seeded SWI performed remarkably better than transplanted SWI. Reports also revealed that direct seeded SWI performed remarkably better than trans planted SWI due to the following reasons.

i) Wheat seedlings at the two leaves stage were far more fragile and their stems were much weaker for transplanting.

ii) Transplanting slowed crop development as compared to direct seeding.

iii) Direct- seeded plants grew faster and more vigorously.

iv) Yield parameters namely number of tillers/plants, panicles plant, percent fertile tillers, panicle length, and number of grains/panicles were substantially lower under transplanted SWI compared to direct seeded SWI.

v) Crop development and subsequent ripening of the panicles under transplanted SWI were not as uniform as direct seeded treatment. Even some of the smaller and younger panicles were not fully ripe at harvest.

Conclusion

Summarily, it could be stated that SWI has shown advanced performance on all measured growth parameters, yield attributes, and grain yield compared to the conventional method. Farmers from different parts of the world are convinced of the encouraging results of SWI, as this technique performs equally properly both in favorable and unfavorable (climatic stress) situations. The SWI technology has already established its strength in terms of multiple advantages like enhanced productivity per unit of land, water, and different inputs with higher economic gain. However, a greater detailed study is needed on various agronomic and other bio-physical changes in the plants under the SWI method. Finally, more skill-oriented training for SWI farmers is required to build up their confidence.