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System of Wheat Intensification

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Introduction

Wheat (*Triticum aestivum* L.) is a widely cultivated food crop in diverse ecosystems around the world, which contributes more calories and protein to human diet. It is the important staple food of about two billion people (36% of the world population). World production of wheat is 796.9 million metric tonnes, making it the second most important cereal. India is the second largest producer of wheat after China. In India, wheat occupies an area of 341.57 lakh ha with a production of 1120.19 lakh tonnes. As the performance galore of input-intensive technology wane away, the perpetuated low and declining productivity of wheat is a major challenge. This type of farming might not be able to sustainably supply the food needs of the world's expanding population. Within this framework, wheat agriculture exhibits more potential for output enhancement when using the principles of the system of crop intensification (SCI), an innovation in rice production. The Principles of System of Crop Intensification (SCI), an innovation that provides opportunity for higher production per unit of agricultural inputs like fertilizer, seed, etc. Encouraging results obtained by implementation of wheat intensification (SWI) or adopting SCI principles in wheat farming. System of Wheat Intensification (SWI) method of wheat cultivation is one of the most effective methods which gives two to three times higher production with low cost and without harming the environment. This methodology of wheat cultivation can increase yield by two to three times through some improvements in crop management factors.This methodology of wheat cultivation can increase yield by two to three times through some improvements in crop management factors.

What is system of wheat intensification?

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.

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Why is SWI necessary?

The SWI is an adaptation of techniques used in the SRI. Regarding agricultural productivity, the farming system's sustainability is a significant concern. It is only with the use of more intensive inputs, such as seeds, chemical fertilizers, herbicides, plant protection chemicals, etc., that North India's more than 10 million hectares under rice-wheat cropping system are among the most intensively cultivated places in the world. The soil, environment, and system productivity may all suffer from the unbalanced u se of external inputs, especially agrochemicals (fertilizer, fungicides, pesticides, and herbicides).

Principles of SWI

SWI is primarily based on following two principles of crop production:

1. **Principle of root development:** A crop plant needs to be firmly anchored from the root system in order to develop properly. For any plant to grow and develop healthily, root development is the first stage. It requires proper nourishment and sufficient space around the plant. The appropriate growth and development of crop plants depends on the distance between them.
2. **Principle of intensive care:** Intensification is more accurately defined as careful space management and meticulous plant care than as a high plant density per unit area. In order to maximize yield, plants must receive meticulous attention at every stage of development, with specially management of weed, insect-pest, disease, organic manure and irrigation.

Package of practices for SWI

The fundamental practices of wheat cultivation are mostly unchanged in SWI; however it generate a favourable environment by altering the sowing geometry, weed management and stressing on organic manuring. To successfully increase grain and straw yield, SWI needs to take the following steps:

Land selection and preparation

Wheat grows best in well-drained, loamy, fertile soil that has a pH between 6.0 and 8.5. To get good tilth for wheat sowing in SWI, three ploughings are necessary. The purpose of the first plowing is to get rid of the roots of the previous crop; the second plowing is done when compost has been spread after a month or two; and the final plowing is done right before wheat seeds are sown.

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Manure application

A healthy crop of wheat needs the right proportion of Nitrogen, Phosphorus and Potassium (80–125:40–60:30–40 kg/ha). To maintain the balance of essential nutrients, soil tests based on nutrient content have been recommended followed by the application of organic manures (farm yard manure, vermicompost, NADEP compost, liquid manure like panchagavya, amritghol, and matkakhad or PAM) and other manures (crop residue and animal dung are commonly used for this purpose).

Seed selection and treatment

20–25 kg/ha of robust, healthy wheat seeds are harvested by immersing the seeds in a 20% salted water solution and discarding any floating seeds. Therefore, a mixture of 10 liters of warm water (600C), 2 kilograms of vermicompost or well-decomposed compost, 3 liters of cow urine, and 2 kilograms of jaggery produced in an earthen pot is used for seed treatment. 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 can be prepared for more amounts of seed for treatment. The next stage is to use a filter to separate the seeds from the mixture and then wash with clean water. Treated seeds are kept in shade for 10–12 hours and by this time seeds fully sprout.

Sowing

Two seeds will be sown each hill using the dibbling method. Different row to row and plant to plant spacing (15 cm × 15 cm or 20 cm × 20 cm) can be used depending on the moisture content. For sowing, a motorized or manually operated seed drill can be used. Seeds will be sown at a depth of 2.5–3.0 cm. Gap filling is done with germinated seeds and extra seeds germinated in a hill removed to reduce competition.

Weed management

Hoeing is essential component of SWI since it ruins the weeds that compete with crop for space, light, water and nutrients. It also loosens the soils and effectively aerates the roots, allowing exploration of soil that leads to better water and nutrients absorption from deeper soil depth. Weeds are integrated into the soil, improving its ability to retain water and its nutritional status. In SWI normally weeding is done 2-3 times, first weeding at 20- 25 days after sowing (DAS). Subsequent weeding is carried out at an interval of 10 days.

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Water management

In SWI, the soil is kept alternately wet and dry, and 3-5 irrigations may be given as per soil moisture status. First irrigation is given at 15 DAS, before the crown root initiation (CRI) and second 40 DAS as the soil develop hairline cracks. The third irrigation was given at 75 DAS, the fourth at flowering, and the fifth irrigation at the grain-filling stage.

Pest and disease management

Disease and insect - pest resistant varieties are selected and seed treatment is done before sowing. In SWI, the application of biological pest control strategies such as biological agents and organic pesticides is recommended.

Harvesting

When the SWI package and procedures are correctly implemented, the crop matures on time and

harvested when the moisture content of wheat grain is around 20-25%.

Benefits of SWI

- More number of effective tillers
- No lodging of crop and increased production
- Early anthesis and crop maturity (4- 5 days)
- Good grain quality
- More fodder available for cattle
- No/lesser disease incidence and insect infestation
- Less seed requirement (Only 20-25 kg/ha)
- Weeding facilitated good aeration to roots
- Less water requirement (20-30 %)
- High seed germination rate and better plant stand
- Fertility of soil is also improved

Constraints in SWI

- Capacity building of farmers in adoption of SWI
- To ensure irrigation at critical stages of crop growth
- Intensive scientific study need to be done at research station

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Conclusion

When compared to conventional ways, the system of wheat intensification farming techniques has demonstrated a good response on all measured growth metrics, yield parameters, and yield production. It responds favorably to increased spacing and seed treatment. It enhanced productivity per unit land, water and other inputs with higher economic gain. To boost confidence, SWI farmers need more skill-oriented training and a more thorough analysis of diverse agronomic and other biophysical changes.

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