Impact of Establishment Methods on Weed Shift and Crop Yield in Rice-Wheat System

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Rice-Wheat (RW) Cropping System

- The demand for food grains in India by 2030 will be 345 MT.

- RW covers 13.5 m ha area in South Asia, of which 10.3 m ha is under IGP (Ahmad et al., 2013), which is known as “food bowl” or “food basket” of the country.

- Contribute >80% of total cereal production.

- Contributes about 90% rice & 60% wheat to PDS and thus considered as back bone of country’s food security.
Sustainability in rice-wheat system in Indo-Gangetic Plains

- Yield stagnation
  - Yield gap
  - Receding water table
  - Nutrient mining
  - Declining factor productivity
  - Low input use efficiency
  - Decline in soil organic matter
  - Reduced biodiversity
  - Environment pollution

- Delayed rice transplanting
  - Low price of produce
  - Less incentive

- Water shortage
  - Residue burning
    - Late onset of monsoon
    - Less ground water use in eastern IGP
    - Labor shortage
    - Power constraints tillage, irrigation
    - Puddling

- Low nutrient use
  - Short turn-around
  - Excessive tillage
  - Long duration rice varieties
  - Excessive soil moisture in eastern IGP
  - Power constraint

- Late sowing of wheat
• In recent years, despite of the application of optimum levels of inputs, rice-wheat has started suffering a production fatigue in productivity due to weeds, causing enormous losses in yield.

• Yield reduction vary upto the extent of 15-48.1% in weedy plots of the transplanted rice (Kiran and Subramanyam, 2010; Manhas et al., 2012 and Kumar et al., 2013), however total loss in grain yield upto 100% was recorded under direct seeded rice (Jabran et al., 2012 and Ganie et al., 2014).

• Conventionally tilled wheat recorded 33.5% grain yield loss while, it was 21.3% in zero tilled wheat in weedy check plots compared to two hand weeded plots (Dhyani et al., 2010).
Constraints in Transplanted Rice

- Unavailability of labour on time
- Late rice planting
- Drudgery to farm workers
- Less plant population
- Increasing fuel cost
- More cost involved in tractor maintenance etc.
- High production cost
- Required high volume of water
- Restricted root growth
- Adverse effect on soil physical conditions
RICE

Transplanting (Anaerobic)

- Puddling
- Water percolation
- Weed suppression

Shift

Direct Seeding (Aerobic)

Biggest constraint

Weeds

- Grasses
- Non-grasses
- Sedges

(Water absence)
Alternatives!

Resource conservation technologies (RCTs)

- Attention must be given to adoption of RCTs
- Grow more food from marginal land

**HOW – help RCTs**

- Produce more
- Less cost
- Preserve ecological integrity

**By**

- Saving water
- Eliminating tillage
- Improving efficiency of external input

**Better opportunities**

- Offer

**Better livelihood**

- Reduce cost of cultivation
- Food for the resource poor
- Densely populated
- Small and marginal farmers
Main aim is Weed control

Conventional methods ➔ expensive, tedious, weather dependent.

Need to move towards conservation agriculture ➔ save water and nutrients, reduce incidence of weeds, improve soil health, increase productivity and conserve the environment.

This leads to shift in weed species with adoption of ZT and dry seeding (Shahzad et al., 2016) which is needed to be controlled and is absent in conventional till systems.
**Crop Establishment and Weed Management Methods Under RCT**

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**Weed management methods**

- Recommended Herbicide
- Integrated Weed Management (Herbicide + Manual weeding)
- Weedy check
Shift in weed flora under rice establishment methods
Effect of different establishment methods on weed density (no/m²) in rice under rice-wheat system
Weed flora shift under wheat establishment methods
Effect of different establishment methods on weed density (no/m²) in wheat under rice-wheat system
Yield of rice and wheat under different establishment system and weed management practices
Effect of establishment methods and weed management on yield of rice under rice-wheat cropping system (pooled data of 3 years)
Effect of establishment methods and weed management on yield of wheat under rice-wheat cropping system (pooled data of 3 years)
Effect of establishment methods and weed management on total yield of rice and wheat under rice-wheat system (pooled data of 3 years)
Conclusions
• *Ammania baccifera* density decreased, whereas *L. chinensis* and *C. rotundus* density increased under unpuddled rice –wheat sequence (DSR or ZTR).

• Under Zero tilled situation, density of *P. minor* has decreased whereas that of *Medicago denticulata* has increased.

• Among the establishment methods, TPR(CT)-ZT wheat- Sesbania with IWM gives higher total system yield (Rice+ Wheat)

  **But**

• For maintaining sustainability of the R-W system, RCT with Residue retention (+ Sesbania) is best.
Thank you...