Harvest weed seed control: Potential in rice crops

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Harvest weed seed control

- A major weakness of many weed species is that they retain their seed at maturity.
- Seed of plants that survive until harvest are collected and spread across the paddock.
Harvest weed seed control

- Targets weed seed production
- Aims to prevent seed from entering the seed bank
- Relies on seed entering the harvester
- Seed is destroyed at that time or later

- Annual ryegrass - harvest height of 10cm captures up to 85% of seed & up to 99% of seed destroyed
Results from dryland cropping

The addition of HWSC has further reduced seed numbers compared to the use of herbicides alone.
Why HWSC in rice?

• Significant levels of resistance to bensulfuran
• Few alternative herbicides
• Increased selection pressure on remaining herbicides
• Need to prolong the life of the remaining effective herbicides
What is harvest weed seed control?

• Suite of many different management practices

• All equally effective

• Vary in cost and complexity

• All farmer innovations
Narrow windrow burning

- Most common form – 30% of Australian growers
- Simple and low cost
- Windrows later burnt
- Targets both chaff and straw fraction

- 99% control of both ryegrass and wild radish
Narrow windrow burning
Narrow windrow burning

Image:stawelltimes.com.au

Image:ahri.uwa.edu.au
The HWSC systems

Chaff carts

- Collection bin towed behind harvester
- Targets chaff fraction only
- Bins emptied at set intervals
- Heaps burnt, grazed or removed
- Up to 85% of ryegrass and wild radish seed collected and removed
Chaff carts
Chaff carts

- Grazed
- Baled
- Burned
The HWSC systems

Bale direct

- Large square baler towed behind harvester
- Targets both straw and chaff fraction
- Financial opportunity where residue is a problem and there is a market for straw
- Lack of markets has limited uptake
- Up to 95% of annual ryegrass seed removed in baled harvest residues
Bale direct
The HWSC systems

Chaff lining or tramlining

• Targets chaff fraction only
• Confines chaff on a tramline or row
• Hostile environment for weed seeds
• Residue is then left to rot (mulch)
• 30 – 90% annual ryegrass seed kill
Tram lining
The HWSC systems

Harrington seed destructor

• Uses a cage mill to destroy weed seeds at harvest
• Targets chaff fraction only
• Originally towed behind unit, now integrated into harvester
• Large capital expense
• 95% control of both ryegrass and wild radish
Harrington seed destructor

Images:grdc.com.au
Integrated HSD

Image: farmweekly.com.au

Image: John Broster
Constraints for HWSC systems

Irrigation bays

• Logistics of trail behind units
• Weeds on banks and drains not captured

Irrigation water

• Result in movement of windrows or mulch rows

Aerial or broadcast seeding

• Increases the risk of fire escaping from windrows
Constraints for HWSC systems

Amount of dry matter produced

• Need to harvest lower may compromise harvest speed and efficiency

Stripper fronts

• Higher straw height left excludes narrow windrow burning
Advantages for HWSC systems

Burning of narrow windows or chaff dumps

- Harvest is at end of fire season not start
- Most paddocks are burnt after rice before the next crop so escapes from narrow windrows are less of an issue

Harvest height

- Some years and varieties have high level of lodging, these already need to harvested at a low height
Weeds of Australian rice

Major species

• Barnyard grass (*Echinochloa crus-galli*)
• Dirty Dora (*Cyperus difformis*)
• Starfruit (*Damisonium minus*)
• Arrowhead (*Sagittaria montevidensis*)
• Water plantain (*Alisma platago-aquatica*)
Weeds of Australian rice

Left: barnyard grass
Right: dirty Dora

Left: starfruit
Right: arrowhead
Suitability for HWSC

Seed retained at harvest

• Minimal research undertaken
• Barnyard grass, starfruit and dirty Dora found in grain samples at Mill Laboratories
• Water plantain - 50% retained (range 10-90%)
Suitability for HWSC

Seed able to be harvested (height)

- Minimal research undertaken
- Large percentage of barnyard grass and dirty Dora seed heads above the canopy
- Water plantain – none below 29cm
Suitability for HWSC

Seed bank turnover

- HWSC works best with short seed bank life
- Many species have high germination within 12 months of seed set suggest short seed bank life
- Complication – in absence of ideal germination conditions they have the ability to remain dormant for a long time
Required research

Determine species to be targeted

- Level of seed retention
- Required harvest height
- Where do weed seeds finish?
  - grain, straw and/or chaff fraction
  - This is mainly a harvester set up issue
- Can the weed seeds be destroyed?
  - Fire, mulch and/or iHSD
Conclusions

• Potential to extend the life of current herbicides

• May not be suitable for all weed species

• Not all HWSC systems will be suitable for rice
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