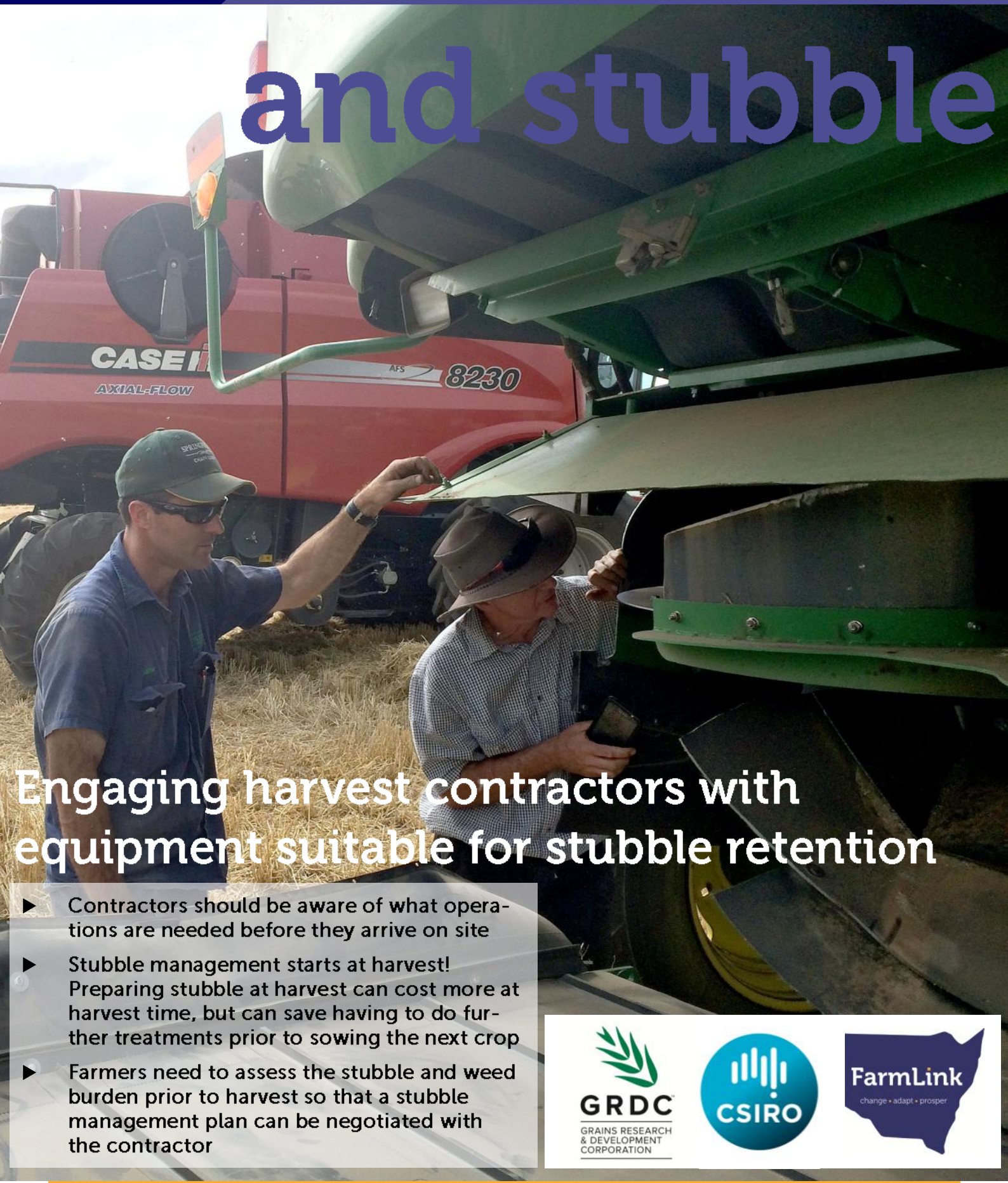
Contractors and stubble



Engaging harvest contractors with equipment suitable for stubble retention

- Contractors should be aware of what operations are needed before they arrive on site
- Stubble management starts at harvest! Preparing stubble at harvest can cost more at harvest time, but can save having to do further treatments prior to sowing the next crop
- Farmers need to assess the stubble and weed burden prior to harvest so that a stubble management plan can be negotiated with the contractor

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Engaging contractors with equipment for stubble retention

Contractors are important at harvest. Photo: FarmLink

Many farmers use contractors for harvesting as it can take the pressure off their own resources at a critical time, or can provide specialist harvesting of different crops with the latest equipment. In the past, farmers were mostly interested in when the contractor would be available to begin harvest and how much it will cost. The relationship between contractors and the farmer client has become a lot more complex, especially with how the stubble is managed. There are a lot of details that need to be discussed to ensure that the job is done properly. If there are specific requirements about how the harvest needs to proceed, then these need to be negotiated before the contractor arrives on site, so that there are no surprises that can cause disputes or hold-ups. The Australian Custom Harvesters Inc. (formerly Australian Grain Harvesters Assn) have guidelines that help to bring contractors and farmer clients to a mutual agreement on how harvest is done. (http://www.customharvesters.org.au/)

Harvest requirements

If a contractor is involved in harvesting then a list of crops with maturity dates, the area that needs harvesting and the yield potential for each paddock needs to be made available. A simple spreadsheet is usually available from agronomists that will show these details. This could also show what type of stubble needs to be left. Integrated weed control using cultural techniques for avoiding herbicide resistance and preparing stubble so that it is in a suitable condition for planting the next crop are the most important management considerations, and will determine -

- whether the residue needs to be cut short or long,
- if stubble needs to be left standing intact, or cut and spread evenly across the swathe.
- whether to put into narrow windrows or a chaff cart for burning resistant weeds
- if the farm is using a Controlled Traffic Farming (CTF) system then there needs to be provision of headers and chaser bins that will fit the permanent tram tracks in use.
- if accurate yield mapping is required then the GPS set up and access to farm's base station needs to be provided.

Contract harvesters

The Australian Custom Harvesters Assn has a checklist of options that need to be negotiated before an agreement is made to harvest crops. Contractors have a large investment in machinery that needs to be run at a profit and variations from paddock to paddock and crop to crop need to be factored into the price. Stubble management at harvest will be an added cost for the different operations that may be done.

This is determined by the hourly cost to run the equipment as machinery depreciates on an hourly basis, not per hectare. This can then be converted to a cost per hectare depending on the crop. For example with an New Holland CR8090 twin pitch rotor with a 12 metre MacDon™ draper front, to cut stubble at 10cm the costs are 30% higher per hectare than cutting stubble at 30cm, because the machine is using 11% more fuel as it processes the extra 20cm of stubble and harvesting speed is reduced from 13.3 km/hr to 10.3 Km/hr.

These calculations are based on an hourly rate for the machine of $600 and were done in a wheat crop that averaged 1.71 t/ha overall. The advantage is that the stubble can be spread or windrowed directly from the header and no other operation is needed during the fallow period to prepare for sowing the next crop.

Table 1 – Cost of harvesting wheat at 10cm compared to 30cm (Rod Gribble, ACH, 2014)

Harvest height	Efficiency Ha/hr	Speed km/hr	Fuel l/hr	Grain Yield tonne/Ha	Cost $/ha	Cost $/tonne
30cm	11.8	13.3	58.1	1.9	$51.0	$26.3
10cm	9.0	10.3	64.8	2.1	$66.5	$32.2
% Change to 10cm	-23%	-22%	+10%	+6%	+23%	+19%

Using a NH CR8090 (Operating cost $600/hr harvesting wheat) Yield monitor figures quoted.

Stubble management operations that will affect the cost of harvest

Crop types and paddock characteristics

Some crops and specific varieties have different characteristics that affect the way they are harvested. The amount of crop biomass and architecture will vary. Some crops may be lodged or have bulky stubbles.

The pulse crops like field peas, lentils and lupins have very fine residues that make them more of a fire risk at harvest, so are harder and slower to harvest, but the residue breaks down quickly and rarely causes problems at sowing. Cereals and canola have residues that can take a long time to break down, often still persisting after several years.

By chopping fine and spreading across the harvest swathe the residue will be able to break down over the fallow period and not cause problems for the next crop. This may involve harvesting slower. Alternatively if the stubble is left standing it can be sown inter-row using accurate RTK GPS. The paddocks can all vary as well depending on topography and layout, whether there are obstacles such as trees or rocky areas. All these variations will affect the cost of harvesting.

Engaging contractors with equipment for stubble retention

Precision Agriculture

This is becoming more common as farms have the capability of using GPS guidance, use Controlled Traffic Farming (CTF) techniques and yield mapping to increase efficiency of farm operations. For these systems to be used to their full benefit then a harvest contractor needs to fit in with the guidelines. The advice from CTF advocates is to start with the header configuration width as it is relatively easy to change the wheel spacing of the other machinery used in the paddock compared with the header. Headers may have to change from one size front to another to fit in with different swathe widths used on different farms. This could vary from 9-12 metre. Some farms may have their own header fronts for contractors to use.

Prototype iHSD at Holbrook.
Photo: Grassroots Agronomy

Machine capacity

This is an important consideration when engaging a contractor. Large capacity machines will obviously be able to harvest crop more quickly than a smaller machine, but another factor is that they will be better able to handle different stubble options such as cutting lower and distributing the residues in a timely fashion if required. If stubble needs special treatment then a large capacity machine will be more suitable, especially when harvest needs to be done quickly. These machines will be capable of handling stubble management options and getting the crop off quickly, at a higher cost per hour, but often lower cost per tonne of grain.

Table 2. Modern headers per class category (http://www.agweb.com/assets/1/6/combine-classes)

Class 6	Class 7	Class 8	Classes 9 & 10
Massey Ferguson 9520 (234kW)	Massey Ferguson 9540 (276kW)	Massey Ferguson 9560 (343kW)	
Case IH Axial Flow 6140 (260kW)	Case IH Axial Flow 7230 (284kW)	Case IH Axial Flow 8230 (336kW)	Case IH Axial Flow 9230 (373kW)
New Holland CX8060 (240kW)	New Holland CR7090 (330kW)	New Holland CR8090 (360kW)	New Holland CR9090 (420kW)
John Deere S660 (239kW)	John Deere S670 (278kW)	John Deere S680 (353kW)	John Deere S690 (405kW)

Table 3. Estimated header charges for class 6, 7, 8 and 9 headers with a 12m draper front, P/U reels, yield mapping and auto steer in 2016 for harvesting wheat (Customharvesters.org.au).

	Class 6	Class 7	Class 8	Class 9
Suggested Hourly Rate	$580	$615	$680	$720

Additional options added such as 4WD, duals, tracks, flex drapers etc are not included in these costings. Prices outlined above are GST exclusive with fuel to be supplied by the grower.

Stripper fronts vs knife fronts

The basic concept of the stripper header is that a rearwards rotating rotor fitted in the front of the header is fitted with rows of stripping fingers that strip grain from the crop as the combine moves the head forwards while it spins backwards. 85% of the grain is threshed meaning the material entering the combine is predominantly grain, chaff, leaf and minimal straw. The benefit of this reduced bulk entering the combine is significantly improved capacity and efficiency. Capacity for similar knife front header may be around 35-tonne/hour, but with a stripper front can be up to 62.5 tonne/hour. Other benefits include improved performance in green, high moisture and weed infested crops. This system is ideally suited to using a disc seeder to inter-row sow the next crop, as stubble is left intact and leaves little residue on the surface. The problem with this, however, is a large volume of tall cereal stubble may be left to plant the new crop into and for some crops, particularly canola, it can impede early growth as stubble can limit the amount of light that penetrates to soil level. Advantages of a knife front are that stubble height can be varied depending on how stubble needs to be treated during the fallow period leading up to sowing the next crop. This is particularly important if using a tine seeder that needs residues to be less than 3 tonnes/h to sow efficiently without blockages. Cut low and evenly spread across the swathe width may be the best option.

Table 4: 'The cost of harvesting Suntop wheat in 2014 at different harvest heights. (Source Farmlink/CSIRO)

Cut height	Efficiency (ha/h)	Speed (km/hr)	Fuel (l/h)	Fuel (l/ha)	Efficiency (t/hr)	Yield (t/ha
Tall (60cm) Stripper front	9.5	10.6	51.2	5.4	28.8	2.19
Short (15cm)	5.7	6.2	54.3	9.6	14.0	2.05
% Change harvesting short	-41	-42	+6	+78	-51	-6

Values are means of three replicates taken from John Deere 9770 STS yield monitor and all differences are significant (P<0.05).

Engaging contractors with equipment for stubble retention

Resistant weed control

Herbicide resistant weeds have become a major problem that farmers need to deal with in modern cropping systems. Conservation cropping systems have been based on using herbicides, and after 30 years of constant use of just a few chemicals the system now needs cultural weed control methods. Rather than go back to cultivation, other techniques have been developed that are effective. Harvest Weed Seed Controls (HWSC) include collecting weed seeds in crop residue (chaff carts, chaff deck and narrow windrow burning) and the Harrington Seed Destructor (HSD) that grinds up weed seeds (and crop residues). These HWSC techniques are all based around an efficient collection system at harvest, so getting contractors that are capable of performing these operations is important to reducing weed burdens. The use of a chaff cart towed behind the header to collect residues is not too difficult, but stubble needs to be cut low and the full cart will need to be dumped periodically, which will slow down the operation. The use of a residue chute on the header to form narrow windrows is also not an expensive modification, but again will slow down harvest operations as stubble needs to be cut low to collect as many weed seeds as possible. Research from Charles Sturt University, Wagga showed that by harvesting at 10cm, 88% of annual ryegrass seed is collected by the header, compared to 48% when cut at 40cm. On farm demonstrations have shown that narrow windrow burning (NWB) is effective, it's cheap, but it does involve compromises. Reduced stubble cover, moisture loss, wind erosion, dust and staggered crop germination are some of the downsides, which can be particularly hard for those in stubble retained systems to tolerate. The time, labour and stress associated with burning also make it a challenging task. Re-distribution of stubble nutrients can be a problem with NWB, particularly in CTF systems where the windrows are placed in the same location each time. There is another option now with the release of the Harrington Seed Destructor which grinds the stubble and weed seeds and disperses the residue across the back of the header. This residue is such a fine powder it will decay very quickly on the topsoil and not cause any problems for sowing or crop establishment. This HSD option is now available integrated into a header (iHSD) rather than as towed behind the header.

Table 5. Harvesting wheat in 2015 at 30cm, or 15cm with and without a HSD (Source Farmlink/CSIRO)

Case IH 1920					
Harvest Height	Grain Yield Tonnes/Ha	Engine Load %	Fuel Use L/Ha	Fuel Efficiency L/Hr	Speed Km/Hr
High 30cm	3.1	57.7	10.5	49.7	4
Low 15cm	2.9	65.2	12.3	59.2	4
Low 15cm + iHSD	2.9	78.1	16	76.4	3.9
% Change 15cm	-7%	+12%	+14%	+16%	+1%
% Change 15cm +iHSD	-6%	+35%	+52%	+54%	-1%

Stubble prepared for sowing the next crop

The main problem with stubble for many farmers is that it causes blockages for sowing equipment, herbicide efficacy problems or poor crop establishment, especially when the stubble load is greater than 3 tonne/hectare prior to seeding.

At harvest the options are that it can be cut low (10cm), chopped and spread across the header trail at harvest, or cut high and left intact if using inter-row sowing.

Alternatively it can be mulched, baled, burnt or grazed during the fallow period to avoid problems at sowing.

This means that another machinery operation is required on the paddock to deal with the crop residue.

Narrow windrows for burning. Photo: Phil Bowden; and Chaff Deck fitted to JD header. Photo: AHRI.

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