

3.1 Snow Water Management for Stubble Cropping

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A stated objective for the Innovative Acres project upon its inception in 1981, was to investigate methods of snow water management for increased water use efficiency and higher crop yield. Field data has demonstrated that the addition of 1 cm of available water can increase grain yields by up to 200 kg/ha (Innovative Acres 1986 Report). Therefore, simple crop management changes to reduce soil water evaporation and increase snow water retention can lead to significant yield increases.

The earlier work of Innovative Acres showed the greatest potential for snow moisture management to be in the Grey, Black and Dark Brown soils. In the Brown soil zone, lower snowfall and recurrent melting temperatures make successful capture difficult (Table 3.1.1).

Table 3.1.1 Potential for snow management between soil zones (from Innovative Acres 1988 Report).

	Percent of years with snow management potential		
	Brown	Dark Brown	Black and Grey
Good	17	19	37
Average	33	40	28
Poor	50 [†]	41	35 [‡]

[†] Mainly due to insufficient snow (<7.5 cm).

[‡] Equally due to a lack of snow or poor infiltration because of fall rains.

There is greater potential for snow management in the wetter soil zones. This was verified by comparing the spring soil moisture of fields after summerfallow to that of adjacent stubble fields. The benefit of summerfallow for moisture retention disappeared going from the Brown to the Black soil zone (Table 3.1.2). Furthermore, snow water capture was greater on lower slopes than upper slopes (Table 3.1.3).

Table 3.1.2 Available soil water (cm) at seeding in fields following summerfallow (SF) or crop (ST) by soil zone (from Innovative Acres 1987 Report).

Soil zone		1982	1983	1984	1985	1986	1987	Average
Brown	SF	10	14	14	15	12	15	14
	ST	8	10	8	10	9	9	9
Dark Brown	SF	--	--	19	16	15	15	16
	ST	9	12	11	14	13	11	12
Black	SF	9	13	11	--	--	--	11
	ST	6	15	11	13	11	8	10
Dark Gray & Gray	SF	--	--	--	--	--	--	--
	ST	9	11	12	12	13	7	10

Table 3.1.3 Available soil water (cm) in the fall and at seeding in fields in the Brown and Dark Brown soil zones following summerfallow or crop (from Innovative Acres 1987 Report).

Slope	Stubble			Fallow		
	Fall	Spring	Gain	Fall	Spring	Gain
Lower	4.9	10.2	5.3	13.8	14.8	1.0
Medium	3.9	8.2	4.3	11.6	13.2	1.6
Upper	4.9	7.3	2.4	11.5	13.2	1.8

A further step in snow management is in fall stubble management. Elimination of fall tillage with an application of a herbicide (if necessary) increased snow capture and spring available water. Snow capture was further improved if the stubble was 'sculptured' at harvest. By means of high-low swathing or swather attachments that leave higher strips of stubble in the field, more snow was retained in the field (Table 3.1.4).

Table 3.1.4 Overwinter soil water recharge on adjacent fields with different stubble management (from Innovative Acres 1986 Report).

Comparison	No. of pairs	Difference in soil water recharge (cm)
Undisturbed stubble - summerfallow	22	4.2
Undisturbed stubble - cultivated stubble	28	0.4
Sculptured stubble [†] - even stubble	27	0.4

[†] High/low stubble, swather stripper attachment.

Snow sculpturing by high-low swathing is a simple technique. However, the tall stubble may not be able to support the windrow, and the grain heads may touch the ground. In wet conditions this may lead to problems with grain sprouting. If a straight-cut combine header is used in harvest, this problem is eliminated.

Interest in stubble sculpturing led to the development of a 'stripper' attachment for swathers. This simple device parts the crop as it is cut, so that a narrow strip of higher stubble is left. The stripper attachment was used by Innovative Acre cooperators on a demonstration basis. This device showed problems with losing heads from the strips, and did not consistently capture snow. These problems resulted in the development of the 'clipper' attachment by a farmer, Mr. Mervin Lloyd (see cover, 1985-1988 Innovative Acres reports). The clipper is a narrow section of swather knife driven hydraulically and

mounted with the swather reel above the table. The clipper makes an even, 3-foot wide cut higher than adjacent stubble, and without loss of grain heads. The 'clipper' attachments were investigated more thoroughly by Innovative Acres.

In the fall of 1987, eight sites were chosen in the Brown and Dark Brown soil zones for an initial evaluation of the clipper. In each case, stubble cut with the clipper was compared to even stubble in an adjacent field. Five neutron probe access tubes were placed in the fall in each stubble type. Tubes #1 and #5 were mid-way between clipped strips and tube #3 was placed in the center of the clipped strip. Soil moisture was measured at 20 cm intervals to a depth of 120 cm in fall and in the following spring.

Overwinter recharge in 1987-88 was variable (Table 3.1.5). An average of 2.1 cm of snow water was captured in non-stripped fields and 2.4 cm in stripped fields.

Table 3.1.5 Comparison of snow moisture capture of even stubble and clipped stubble.

Farmer	Available water (cm)							Clipped- Even
	Clipped stubble			Even stubble				
	Fall	Spring	Gain	Fall	Spring	Gain		
<i>1987-88:</i>								
Campbell 1	4.5	6.6	2.1	7.1	9.6	2.5	-0.4	
2	8.7	10.6	1.9	6.4	7.4	1.0	0.9	
Connick	2.0	3.8	1.8	0.8	3.9	3.1	-1.3	
Daviduk	0	1.2	1.2	0	1.3	1.3	-0.1	
Jessiman	8.4	10.4	2.0	8.5	9.0	0.5	1.5	
McAllister	0	4.8	4.8	1.2	4.9	3.7	0.9	
McArthur	NA	NA	4.1	NA	NA	6.8	-2.7	
Robb	12.6	13.9	1.3	16.9	14.7	-2.1	3.4	
<i>1988-89:</i>								
Dumonceaux	7.2	12.6	5.4	9.3	11.9	2.6	2.8	
Androsoff	12.2	17.8	<u>5.6</u>	11.0	16.2	<u>5.2</u>	<u>0.4</u>	
Means (all sites)			3.0			2.5	0.5	

Thus, an average of 0.3 cm was gained with the clipper attachment. Poor snowfall and melting winter temperatures contributed to the small gain in soil moisture. The stripper was used in the Black soil zone at two sites in 1988-89 (Table 3.1.5). At these sites a snow survey was conducted in March before spring thaw. The snow depths in the clipped stubble were markedly greater than for even stubble (Figure 3.1.1). An increase in spring soil moisture was measured where the clipper was used at both sites (Table 3.1.5).

Stubble management can play an important role in snow capture and water availability to the crop. Innovative Acres data supports the benefit of not using fall tillage, and leaving the stubble for snow capture. Preliminary work suggests that stubble sculpturing may provide even greater benefits. Work in stubble management has continued with emphasis on the potential in the Dark Brown and Black soil zones. With a minimum of effort, the farmer may be able to better manage the most limiting nutrient - water.

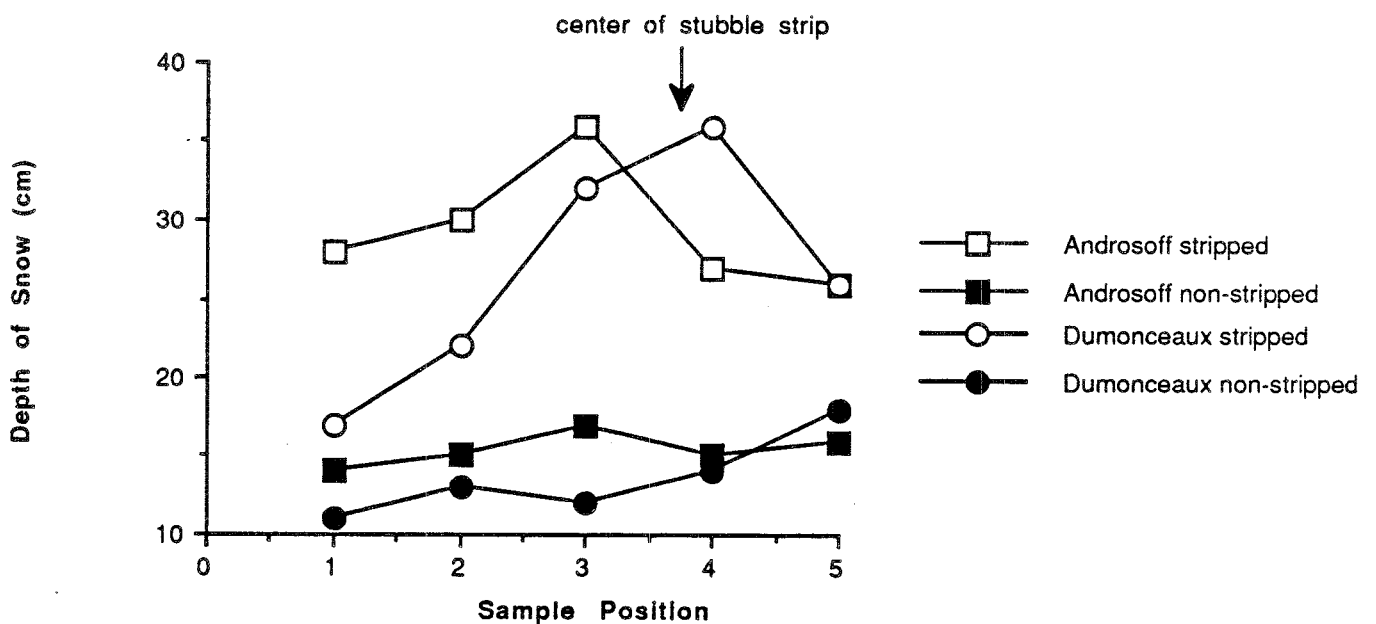


Fig. 3.1.1. Depth of snow in the clipped and even stubble.