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Revision 0:	Shari Lepp	October 11, 2011
Revision 1:	Shari Lepp	October 12, 2011
Revision 2:	Michael Harding	October 26, 2011

Approved By:

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1.0 PURPOSE

1.1 To evaluate the efficacy of Heads Up® Plant Protectant as a seed treatment for control of white mold on dry edible bean.

1.2 To evaluate the efficacy of Heads Up® Plant Protectant tank mixed with an industry standard seed treatment fungicide (Cruiser Maxx® Beans + Streptomycin) for control of white mold on dry edible bean.

2.0 BACKGROUND

White mold caused by *Sclerotinia sclerotiorum* (Lib.) de Bary is one of the most devastating diseases of pulse and legume crops in many areas of the world. It is the main production constraint in dry bean production in many areas of western Canada. Crop rotation is of marginal effectiveness in managing the disease due to the pathogens ability to survive many years in soil as sclerotia. Fungicides are a primary method of disease management however the loss of Ronilan EG (Vinclozolin) has left the dry bean and soybean industry with no fungicide alternatives that equal its efficacy and flexibility. New fungicides, combinations and additives are currently being sought to fill the gap in white mold management on beans.

Heads Up® Plant Protectant is a "is a natural source plant defense 'activator'" that "can be beneficial in controlling several types of fungal and bacterial diseases." (http://www.sar-headsup.com/history.php). It is currently registered in the USA for use on beans and soybeans for control of white mold. The purpose of this study is to evaluate the level of white mold control achieved on dry edible bean in southern Alberta.

3.0 MATERIALS

Table 1. Organisms used.

#	PLANT SPECIES	MARKET CLASS	CULTIVAR
2	*Phaseolus vulgaris* L.	Pinto	'Winchester'
#	**PATHOGEN SPECIES**	**DISEASE**	**SOURCE**
1	*Sclerotinia sclerotiorum* (Lib.) de Bary	White mold	Sclerotia in soil

Table 2. Treatment materials.

TRT	Product	Product Rate	Timing	Placement
1	Check (water)	n/a	Pre-seed	Seed
2	Cruiser Maxx® Beans	195-mL/100kg seed	Pre-seed	Seed
3	Heads Up®	1 gm./litre/160 Kg.Seed	Pre-seed	Seed
4	Heads Up®+ (Cruiser Maxx® Beans + Strep)	Heads Up ® @ 1gm/litre CMB = 195-mL/100kg seed Streptomycin = 5% (w/v)	Pre-seed	Seed

4.0 PROCEDURE

4.1 TREATMENT OF BEAN SEED

Treatment solutions are prepared according to Table 3.

Dry bean seed for treatments 1 and 3 was not commercially treated. Seed for treatments 2 and 4 was commercially treated with a fungicidal seed treatment, Maxim 4SF, Apron Maxx RTA, and a 5% bactericidal seed treatment, streptomycin. A total of 85 seeds per 6-m row were prepared. Seeds were packaged using an Old Mill electronic seed counter, which counted 85-seed batches into small coin envelopes. Packaged seed was kept at 5ºC until seeding.

4.2 PREPARATION OF FIELD, SEEDING AND AGRONOMY

Field 74 of Lendrum Farm at CDCS was opened with a vibrashank-style cultivator. Soil was adjusted to 50-lbs/N per acre and Edge herbicide applied according to label specifications and incorporated by working soil twice with a vibrashank-style cultivator and harrows. Beans were seeded four rows at a time. Rows were 6-m in length and 70-cm apart. Eighty five seeds per row were sown 3-5 cm deep to give a density of 23.5 plants/m^2 (95,000 plants/acre). Treatment rows were arranged in a randomized complete block design with four replicate blocks. A plot plan diagram is given in Figure 1. Beans were seeded using 4-row cone-style disc drill seeder.

4.5 HARVEST PROCEDURE

Beans were undercut when pods reached approximately 75% buckskin appearance. Ten days after undercutting, beans were mature and dry. At that time, plots were machine-harvested using a Wintersteiger plot combine. The harvested seed from the center 2 rows in each 4-row subplot was collected separately in labelled mesh bags. Harvested seed from each subplot was individually weighted using a Denver Instrument DA series weight scale (Model #DA60EDP-LO-US). Each bag was put through a forced-air seed blower to remove the large pieces of dirt and chaff. Each bag was then put through a Clipper Office Tester (Model O.T., Serial #F92050308) to remove smaller chaff and split seeds. Once the bags were put through both machines, they were weighed again using the same scale. A 50-g sub-sample from each subplot was weighed before and after drying (48-hrs @ 65ºC) to determine % moisture.

4.6 DATA COLLECTION

1. Five emergence counts were taken weekly beginning 2- to 3-weeks after seeding. Average emergence is given in Figure 3.
2. Disease ratings were taken after the onset of disease on 25 plants within each subplot
    a. Disease incidence was the % of plants with white mold symptoms
    b. Disease severity was estimated using a scale of 0-5 (see below).
    c. Yield was calculated as grams of harvested seed per subplot.

The plants disease severity was rated using the Kutcher 0-5 rating scale:

0 = no symptoms
1 = infections limited to pods of the plant
2 = ¼ of plant affected, usually one to two main branches
3 = ½ of plant affected, usually two to three main branches
4 = ¾ of plant affected, usually three or more branches
5 = main stem lesion near the base affecting entire plant

RESULTS

Emergence results are given in Figure 3. Disease incidence and severity ratings were first taken 49 DAP. No disease symptoms appeared until the fourth rating taken 80 DAP. White mold incidence and severity after 80 DAP are shown in Figures 4-5. Yield data are shown in Figure 6. Average dockages per treatment are shown in Figure 7. A photograph of the plot is shown in Figure 8. Statistical analyses and raw data are given in Appendix 1.

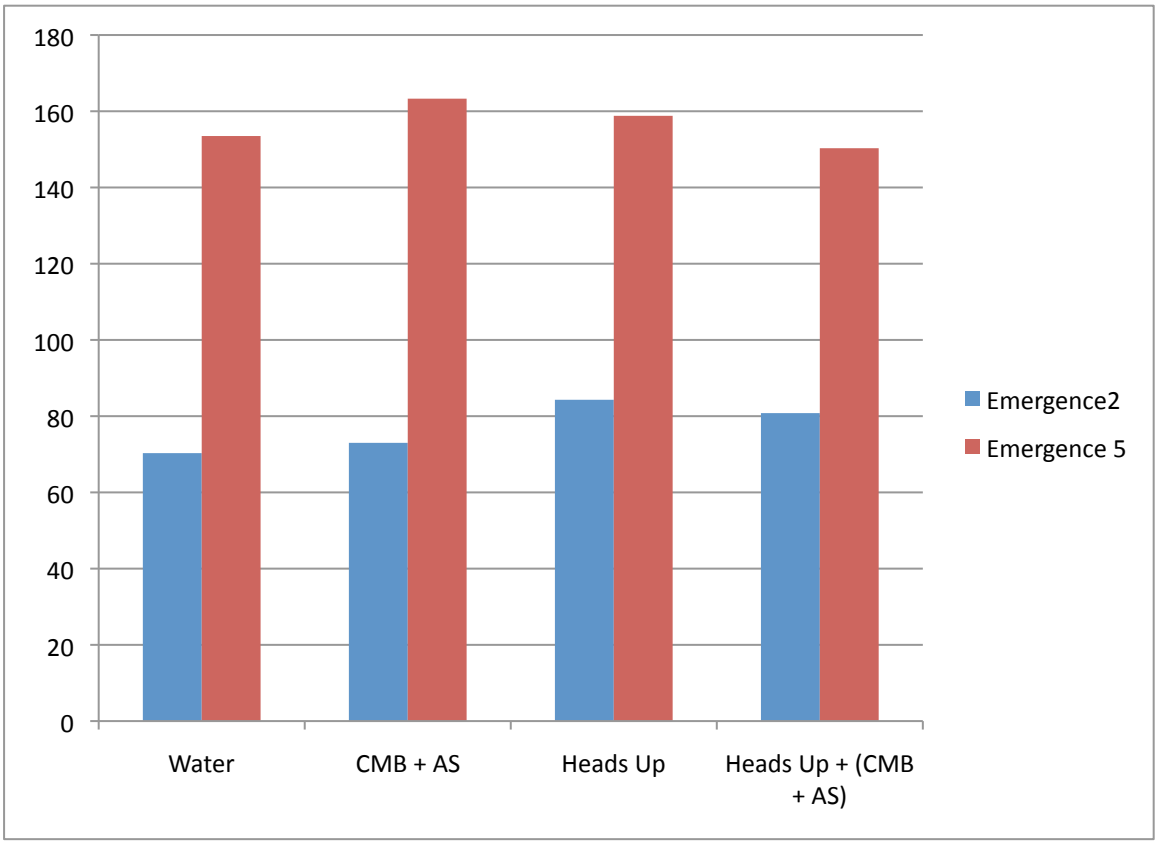

Figure 3: Average emergence approximately 4 weeks (Emergence 2) and 7 weeks (Emergence 5) after planting

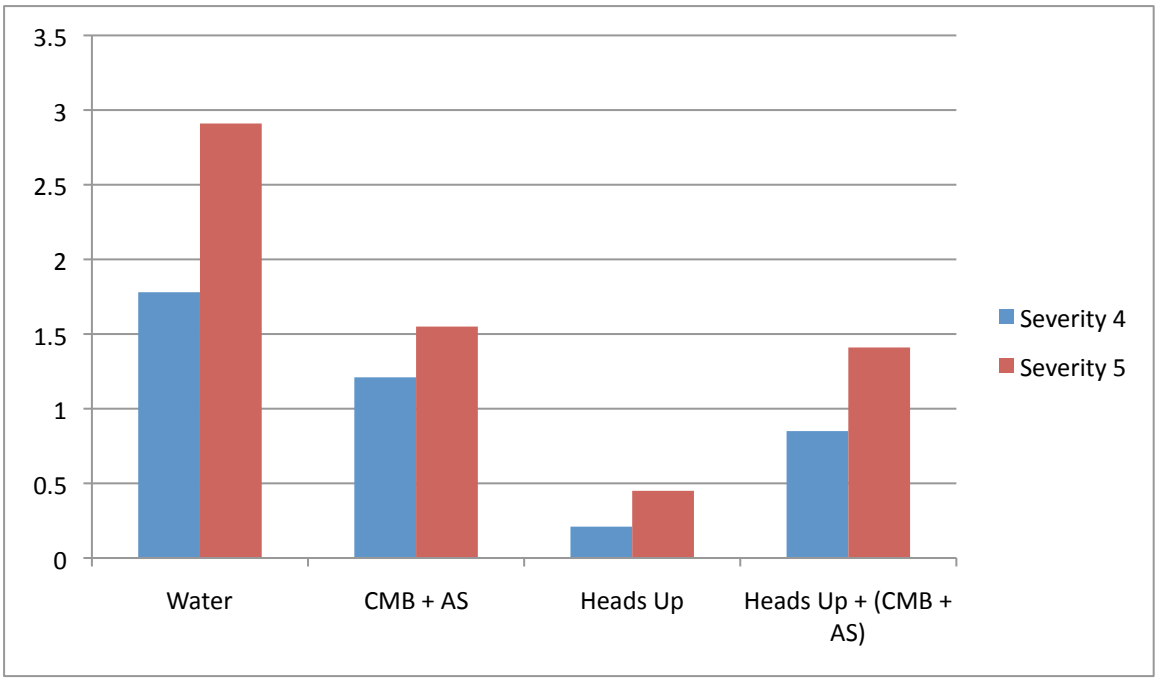

Figure 4: Disease Severity Ratings #4 (18-Aug-2011) and #5 (25-Aug-2011).

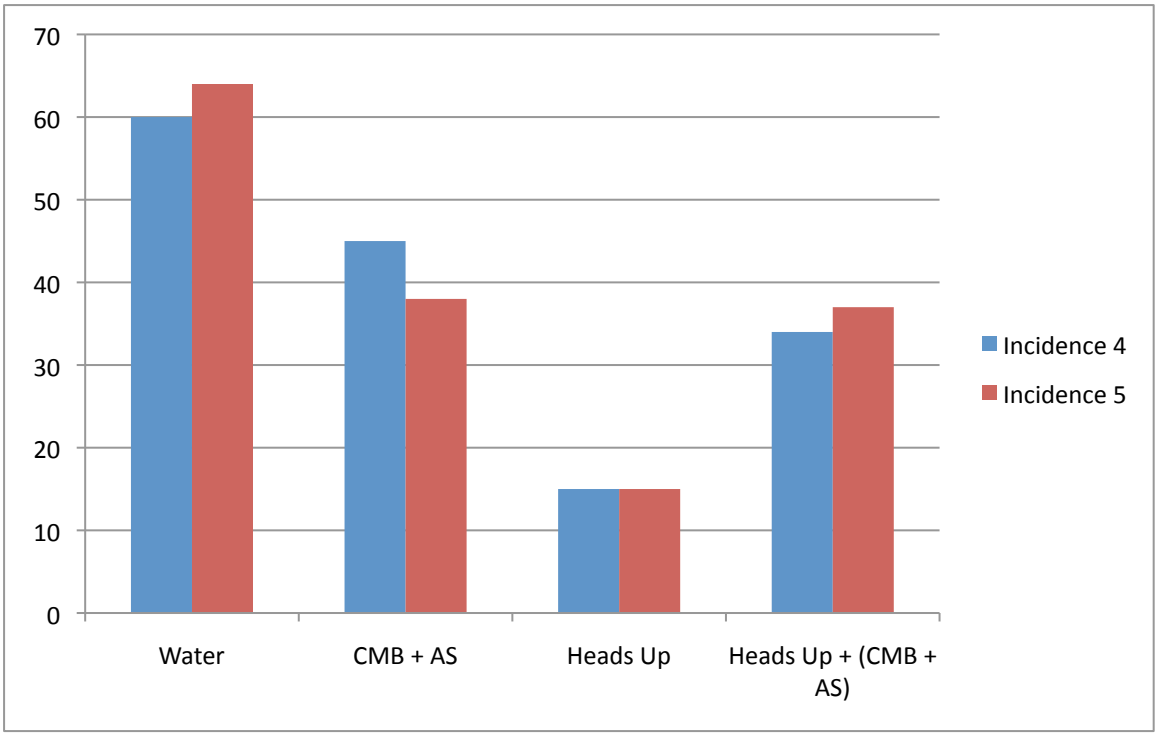

Figure 5: Disease Incidence Ratings #4 (18-Aug-2011) and #5 (25-Aug-2011).

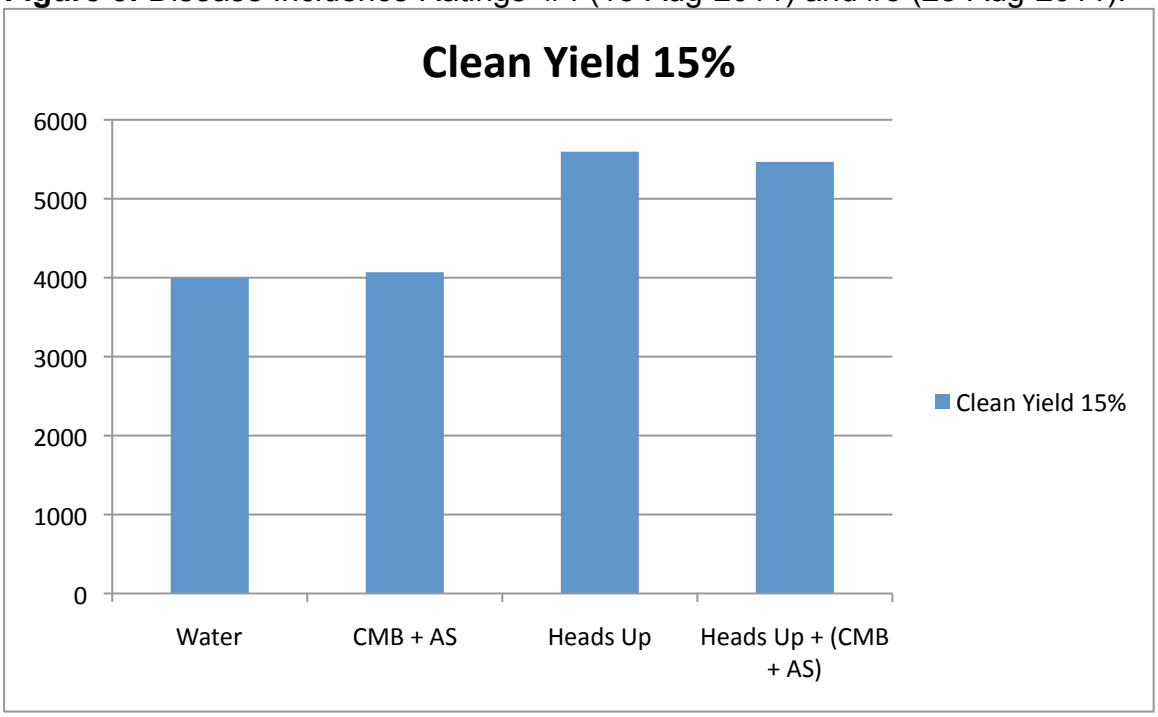

Figure 6: Clean seed yields (adjusted to 15% moisture).

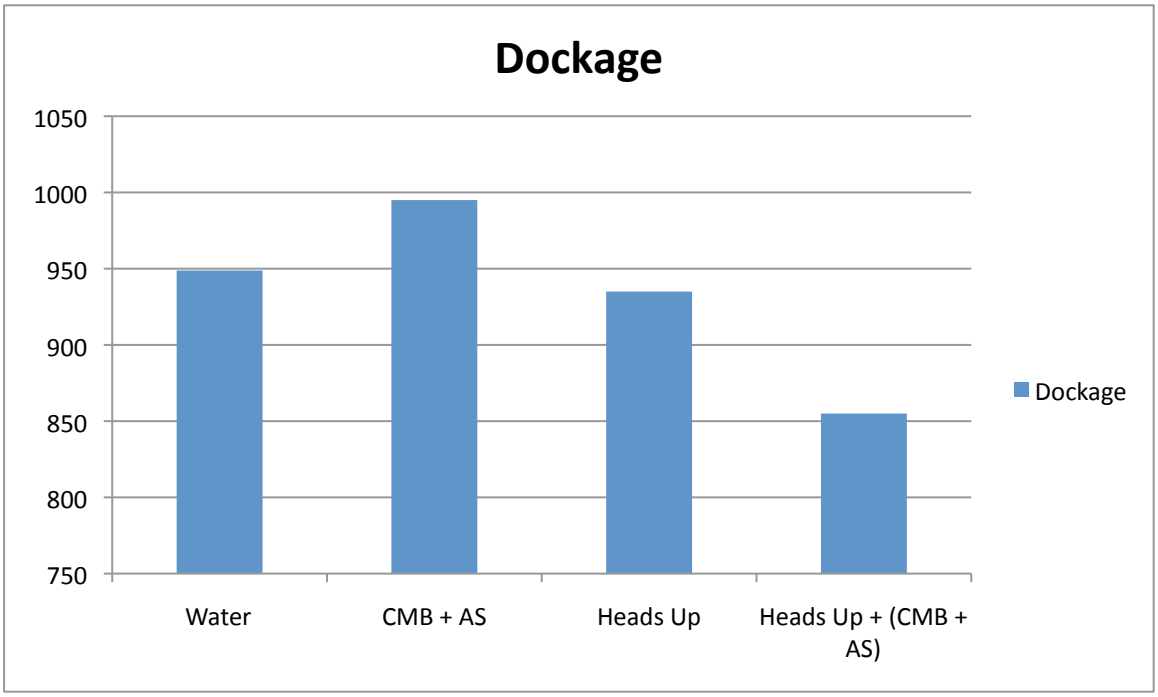

Figure 7: Average dockage per treatment

Figure 8: Plot photo

6.0 SUMMARY

- Heads Up® significantly reduced white mold incidence (77% reduction) and severity (84.5% reduction) compared with the check treatments.
- Heads Up® did not appear to be completely compatible with commercial seed treatment Cruiser Maxx Beans as the level of white mold control was reduced when Heads Up® was applied to seed that had been commercially treated.
- Heads Up® did not have an effect on dockage.
- Heads Up® improved yield by 40% compared with the untreated check