THE EFFECT OF AIRSEEDING ON SEED DAMAGE, PLANT POPULATION AND YIELD OF IRRIGATION DRYBEAN

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ABSTRACT

Dry bean seed at ambient and elevated moisture levels was passed through four different commercial airseeders prior to sowing with standard small plot equipment. Seed damage, plant stand and yield for each treatment were compared to a control treatment. Significant changes in plant stand, yield and in percent visual seed damage were attributable to cultivar, seed moisture and seed distribution system interactions. Passing dry bean seed through airseeding systems with impact distributors caused a significant increase in seed damage and a significant reduction in both plant stand and yield. Raising initial seed moisture content to 16-18% reduced the damage caused by airseeders with impact distributors.

INTRODUCTION

Dry bean production is in the early stage of development in the irrigation districts around Lake Diefenbaker in south-central Saskatchewan. Research and demonstration project results since 1986 indicate that production is economic if growers do not have to invest in new farm equipment (Vandenberg and Slinkard, 1989). Direct harvest combines used for harvesting lentil are available. Many potential bean growers have already invested in airseeding equipment. In most traditional dry bean production areas, plate planters are used. In some new production areas, drill seeding is becoming more popular. Airseeding is not recommended for drybean production because dry bean seed is expensive and gentle handling is required to minimize seed damage. This experiment was conducted with the objective of determining if airseeding of dry bean is possible.

The experiment was designed to measure the effect of cultivar, seed moisture and airseeder distribution system on percent visual damage, plant population and yield of irrigated dry bean. Two-row plots at 60 cm row spacing, 3.7 m length were sown from each batch of seed treated according to all treatment combinations listed in Table 1. There were six replications arranged in randomized complete blocks. The high moisture treatment consisted of adding sufficient water to approximately 2 kg of dry bean seed of ambient moisture content to raise the moisture content to 16-18%. Airseeders were chosen on the basis of the type of distribution system. For each treatment, approximately 2 kg of seed was loaded into the hopper of the airseeder. The air system was activated so that seed travelled through the entire distribution system and was collected in nylon mesh bags at the furrow openers downstream. Collected seed was subsampled by weight and percent visual damage was recorded. The seed was again subsampled by weight to establish intended plant populations of 30 plants/m^2 in the two row plots. The plots were seeded on June 4, 1989 under a linear irrigation system at the Saskatchewan Irrigation Development Centre. A gravity flow belt-cone plot seeder was used. Data were recorded for stand counts of undamaged seedlings at the first trifoliolate stage. Entire plot seed yield was recorded at maturity after direct combining with a Wintersteiger elite small plot combine. An analysis of variance was performed on all data. Percent visual seed damage data were square-root transformed prior to the analysis.

RESULTS AND DISCUSSION

The analysis of variance for percent visual seed damage indicated highly significant effects for all main treatment effects and interactions (Table 2). Figure 1 indicates how raising the initial moisture content reduced seed damage for all airseeder treatments. The greatest amount of seed damage occurred using the airseeder with two impact distributors. Single impact distributor types damaged fewer seeds than the double impact type. Single impact distributors caused more damage to seed of both ambient and elevated moisture content than did either the direct delivery type airseeder or the control.

There were highly significant effects for all main treatments and two-way interactions on plant population (Table 2). Figure 2 shows that plant population was increased for all seeding treatments by raising the moisture level of the seed. The effect was greatest for the double impact distributor type airseeder. At ambient seed moisture level, plant population was reduced by about 50% for the double impact distribution system in comparison to the control. By raising seed moisture level to approximately 16%, plant populations for impact distributor treatments approached those of both the control and the direct delivery treatments. In 1989, soil temperatures were warm by June 4. Under cooler soil conditions, stand reductions from impact distributor air seeder treatments might be further reduced.

There were highly significant effects on yield for seed moisture, airseeder and seed moisture x airseeder interactions (Table 2). Figure 3 indicates that the yield improvement was greatest when the initial seed moisture was raised for the airseeder with the double impact distributor. Single impact distributor airseeders showed the next best yield improvement in response to elevated seed moisture. The control and the direct delivery airseeder showed no improvement in yield when seed moisture level was increased.

The results indicate that it is possible to use airseeding equipment to establish dry bean. Direct delivery systems do the least damage to the seed. This is also the most expensive seeding method. The seed damage, stand reduction and yield loss caused by impact distributors was reduced by raising the initial seed moisture level to 16-18%. The use of airseeding for dry bean production is not recommended at this time. However, these results will be further investigated at the commercial production scale level in 1990. Successful use of airseeders for irrigated dry bean production can remove one more barrier to development of a new crop in south-central Saskatchewan.

ACKNOWLEDGEMENT

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REFERENCES

Vandenberg, A. and A.E. Slinkard. 1989. The evaluation of field bean (*Phaseolus vulgaris* L.) as an alternative grain and seed production crop for the crop for the irrigated regions of south-central Saskatchewan. Final Report. ADF, Regina.

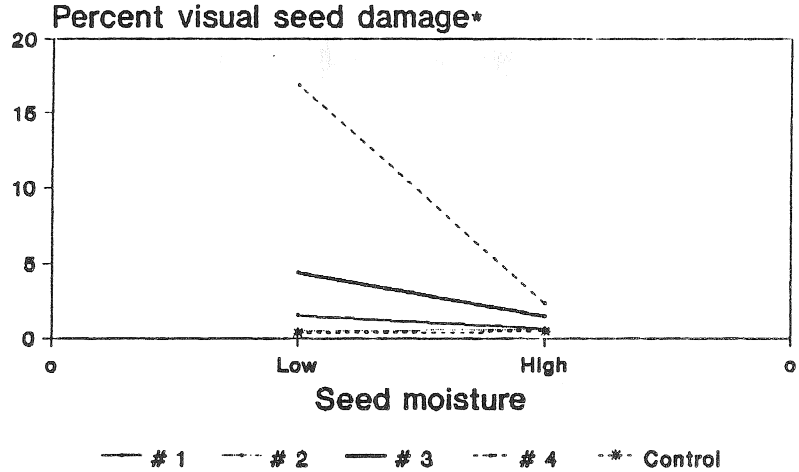
Table 1. Treatment combinations used in the experiment.

Cultivar and seed size	Seed moisture level	Airseeder Number	Airseeder Type of distributor
Beryl - 280 mg	Ambient, low	1	Single impact
Topaz - 240 mg	(about 11.5%)	2	Direct delivery
Topaz - 320 mg	Elevated, high	3	Single impact
	(16-18%)	4	Double impact
		5	Control

Table 2. Analysis of variance of the effect of airseeder, seed moisture and cultivar on percent visual seed damage, plants per square meter and yield of dry bean.

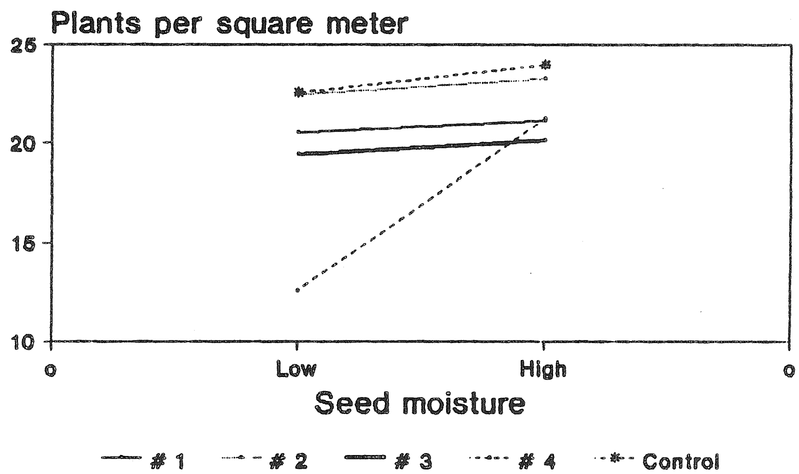
Source of variation	DF	Percent visual damage Mean square	P	Plants per square meter Mean square	P	Yield Mean square ($x 10^2$)	P
Replication	5	0.04	NS	22.68	**	1.44	NS
Cultivar (C)	2	10.57	**	47.72	**	6.05	**
Seed moisture (SM)	1	20.14	**	260.34	**	21.21	**
Airseeder (S)	4	21.98	**	234.89	**	13.77	**
C X SM	2	1.75	**	26.73	**	1.88	NS
C X S	8	0.90	**	24.91	**	1.02	NS
SM X S	4	8.53	**	107.91	**	7.63	**
C X SM X S	8	0.91	**	6.99	NS	1.28	NS
Error	145	0.06		4.70		1.10	

Figure 1. Effect of seed moisture and distribution system on seed damage



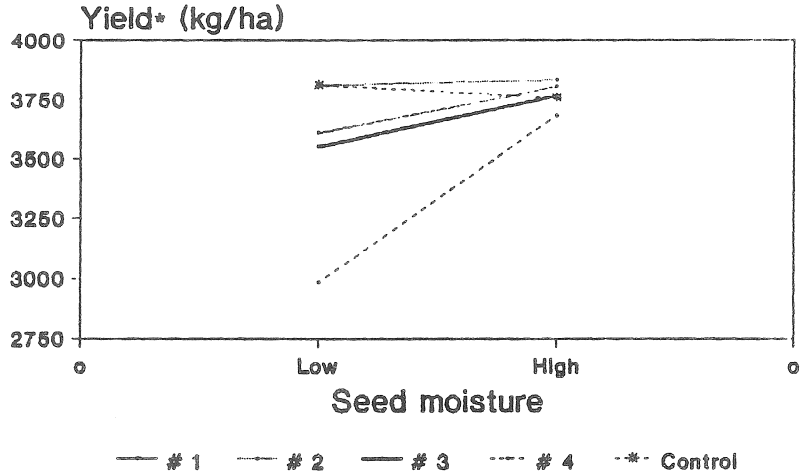
*Mean of three cultivars

Figure 2. Effect of seed moisture and distribution system on plant population



*Mean of three cultivars

Figure 3. Effect of seed moisture and distribution system on dry bean yield



*Mean of three cultivars