Seed production of Stylosanthes guyanensis

3. Effects of pre-harvest desiccation

D.S. Loch, J.M. Hopkinson and B.H. English

Summary—Strips within commercial crops of *Stylosanthes guyanensis* in the Mareeba district of north Queensland were sprayed with diquat 4, 6 and 10 days before harvest and compared with unsprayed strips.

Pre-harvest desiccation made combine harvesting easier, but did not increase harvest yield. Where seed formation and maturation was still possible, desiccation prevented this without substantially increasing the loss of seed to the ground; increased harvest efficiency was thus offset by a diminished quantity of standing seed. However, where there was little or no further potential for seed development, diquat had virtually no effect on the quantity of standing seed or harvest efficiency.

It was concluded that the results warranted neither recommendation nor further evaluation of pre-harvest desiccation of *S. guyanensis* seed crops.

The failure of header-harvesters to recover more than a fraction of the seed known to be carried in the canopy of seed crops of stylo (*Stylosanthes guyanensis*) is partly due to difficulties of seed separation in the harvester (Loch, Hopkinson and English 1976). In well-grown, healthy crops of stylo, machines designed to harvest dry stiff-strawed grain crops are required to handle some 10–20 tonnes ha^{-1} of green, tangled, sticky vegetation which contains only about 600 kg ha^{-1} or less of small seed.

Pre-harvest desiccation by applying diquat approximately one week before the anticipated time of harvest has been suggested (and occasionally tried) as a means of improving efficiency of retrieval in this situation. However, no critical information about this technique with stylo has been published. This paper reports the results of three experiments in which commercial crops of stylo were desiccated with diquat and harvested by the growers with their own headers.

Materials and methods

Within each of three stylo crops in the Mareeba district of north Queensland, an experimental area was divided into ten strips to accommodate the following two treatments arranged in five randomized blocks:

A—unsprayed control;

B—sprayed by hand-operated knapsack with 5.6 l ha^{-1} of diquat plus 5.6 l ha^{-1} of wetting agent ('Agral' 60) in 1350 l ha^{-1} of water.

Details of spraying and harvesting are summarized in table 1.

At a random position within each block, single adjacent 0.4 m^2 quadrats were cut from each treatment on the day of harvest. Differentiation between standing and fallen seed and subsequent procedures for seed recovery were as described by Loch, Hopkinson and English (1976).

Individual plots were direct-headed using conventional self-propelled combine harvesters (see table 1); in each case, it was assumed that, once header cavities had initially been filled by harvesting stylo outside the experimental area, the quantities of seed collected fairly accurately represented the quantities actually harvested from each plot. Samples were later dried at 40°C, cleaned by conventional screening and winnowing, weighed, and subsampled for purity analysis.

Subsamples of about 200 seeds were weighed for determination of mean individual seed weight. Subsamples from each set of replicates for headed and standing seed were bulked and subjected to routine germination analysis at the Queensland Department of Primary Industries Seed Testing Laboratory during October 1972.

The Authors—Mr. D. S. Loch, Dr. J. M. Hopkinson and Mr. B. H. English, Department of Primary Industries, Atherton, Queensland. (Mr. Loch's present address is Department of Primary Industries, Gympie, Queensland).

TABLE 1
Site and treatment details.

Treatment factor	Site 1	2	3
Cultivar	Cook	Endeavour	Cook
Date of spraying	July 21, 1972	July 28, 1972	July 28, 1972
Date of harvest	July 25, 1972	Aug. 3, 1972	Aug. 7, 1972
Desiccation interval (*days*)	4	6	10
Harvester type	Case 600	John Deere 55	New Holland 135
Dimensions of individual plots	45.7m × 3.7m	45.7m × 2.1m	45.7m × 2.7m

Results and discussion

All three machines handled the sprayed plots more easily than the unsprayed. Furthermore, seed quality was unaffected: although the data were not statistically analysed and are not presented, there was no indication that either germination or hardseededness was affected by spraying with diquat. This suggests that the apparent residual toxicity of diquat recorded by Roberts and Griffiths (1973) with *Lolium* does not apply to stylo where the actual seed is protected from direct exposure by the presence of a flimsy pod. However, although costs of production were increased by pre-harvest desiccation, harvested yields were not (table 2).

At site 3, spraying with diquat markedly reduced the headed yield by almost 100 kg ha^{-1}, even though efficiency of retrieval was increased by some 30 per cent. The data on seed yields and mean individual seed size suggest that, in the ten days that elapsed between spraying and harvest, a considerable quantity of standing seed had matured on the unsprayed control. Death of the canopy after spraying arrested developing seeds in various stages of immaturity, so that the sprayed treatment carried considerably less standing seed, and this had not filled out as well as that on treatment A. Improved efficiency of retrieval was thus more than offset by the substantial reduction in the quantity of standing seed.

The crop at site 1 was probably closer to maturity at the time of spraying. Nevertheless, the data, though not as conclusive as from site 3, suggest that a similar situation was developing when the crop was harvested only four days after spraying.

Desiccation six days before harvest had virtually no effect at site 2. However, this crop was overdue for harvest, with approximately 50 per cent of its total

TABLE 2
Quantities and mean size of seed measured at time of harvest, with efficiency of harvest.

Attribute	Site 1 A	Site 1 B	Site 1 L.S.D. (P = 0.05)	Site 2 A	Site 2 B	Site 2 L.S.D. (P = 0.05)	Site 3 A	Site 3 B	Site 3 L.S.D. (P = 0.05)
Heading efficiency† (%)	65	88	—	100	86	—	57	90	—
Seed yields (*kg ha*$^{-1}$)									
Headed	281	302	53	150	121	24	273	176	59
Standing	434	345	139	143	141	47	482	195	162
Fallen	147	170	14	139	152	44	220	270	72
Total	581	515	139	282	294	86	702	465	156
Fallen seed as percentage of total seed yield	23.6	33.1	7.4	49.3	52.4	7.5	31.5	58.6	15.8
Mean individual seed weights (*mg*)									
Headed	2.19	2.14	0.09	2.19	2.14	0.11	2.17	2.08	0.06
Standing	2.16	2.07	0.09	2.16	2.14	0.09	2.13	1.93	0.10
Fallen	2.42	2.44	0.04	2.57	2.56	0.13	2.43	2.41	0.16

† Heading efficiency = (Headed yield/Standing yield) × 100.

yield having already been shed. Most of the seed remaining on the standing crop would have matured before desiccation occurred, and so would have been relatively unaffected by treatment.

It seems, therefore, that spraying with diquat prevents further seed formation and maturation when this is still possible, without markedly affecting rates of loss to the ground. Thus, the longer the interval between spraying and harvest, the greater the discrepancy between sprayed and unsprayed treatments (see sites 1 and 3). However, if there is little or no possibility of further seed formation and maturation, spraying with diquat has virtually no effect (i.e. site 2).

If pre-harvest desiccation were to have any place in the harvesting of stylo, it would have to markedly improve yields to compensate for increased costs and prior commitment to a specific harvest time. However, where efficiency of retrieval can apparently be increased, this advantage is offset by the presentation of less seed to the harvester; and as both are a consequence of the same effect—the death of the canopy—they cannot be separated.

For these reasons, therefore, we have concluded that pre-harvest desiccation has no place in the harvesting of stylo, and that further evaluation is pointless.

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REFERENCES

Loch, D. S., Hopkinson, J. M., and English, B. H. (1976)—Seed production of *Stylosanthes guyanensis*. 1. Growth and development. *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**:218.

Roberts, H. M., and Griffiths, D. J. (1973)—Pre-harvest desiccation of herbage seed crops and its effect on seed quality. *Journal of the British Grassland Society* **28**:189.

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