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THE ECONOMICS OF CHEMICAL DESICCATION AND MECHANICAL DRYING AS METHODS OF REDUCING BIRD DAMAGE IN SUNFLOWER.

L.R. ALLEN
Department of Ecosystem Management, University of New England, Armidale 2350 N.S.W. Australia.

ABSTRACT

In response to the high levels of bird damage experienced by sunflower growers, many methods of controlling birds or reducing bird damage have been developed. This paper attempts to weigh the benefits of two methods, chemical desiccation and mechanical drying, in relation to the cost of applying these methods. Results indicate that for either of these methods to be economically justified as a means of reducing bird damage very large bird numbers are required. For summer harvests, it is unlikely that bird numbers could reach a level that would economically justify the application of these techniques for the purpose of reducing damage.

INTRODUCTION

Detailed surveys undertaken by students from the Department of Ecosystem Management, (University of New England) have estimated bird damage in northern New South Wales at 5 — 30% of yield on a shire (county) basis (de la Motte, 1977; Bennett 1978). These surveys identified the sulphur-crested cockatoo, *Cacatua galerita,* and the galah, *C. roseicapilla,* as the major pest species damaging sunflower.

Chemical desiccation and mechanical drying have been recommended as viable methods of reducing the period of crop susceptibility and hence reducing bird damage (Whitehead, 1977; Besser, 1978; Easdown and Beeton, 1980). For either of these two methods to be economically justified as a technique for reducing bird damage, the cost incurred by desiccating or drying must be less than the cost of additional bird damage incurred between alternative harvest dates.

In this paper a simple equation is generated that allows these and other bird damage control methods to be evaluated.

Method of calculating cockatoo and galah damage to sunflower.

To evaluate the cost of bird damage we can use a simple formula:

$$B.D.(\$) = \frac{(C^n \times 54.8 + G^n \times 36.8)D^n \times S}{10^6}$$

Where C^n and G^n are an estimate of the number of sulphur-crested cockatoos and galahs respectively, that are feeding on the sunflower crop per day. D^n is the number of bird-feeding days, or in this case in the number of days difference between harvest dates. S is the current or expected price per tonne of sunflower seed when sold.

Small (1975) made a rough estimate of cockatoo damage per day, per bird, based on stomach contents from a sample of cockatoos shot after feeding on sunflower. However, a more accurate estimate of the weight of sunflower seed eaten (and wasted) by galahs and cockatoos was made by Broome *et al.,* (1979 unpublished). In this study the mean numbers of cockatoos and galahs per day, the mean number of feeding minutes per bird and the seed eaten or destroyed was recorded for a 55-day period on a sunflower crop of 3.5 hectares.

From these detailed records it was calculated that cockatoos eat or destroy 54.8 grams of sunflower per day per bird and galahs eat or destroy 36.8 grams. The advantage of these estimates is that the figures generated from this approach incorporate the seed actually eaten by birds (unaffected by bird controls), plus the seed wasted or destroyed through decapitation of sunflower heads.

Cockatoo numbers (C^n) and galah numbers (G^n) are not calculated in this analysis. For calculating bird numbers in a field situation, the best technique is a photographic count. Without this technique and especially when large flocks of several thousand birds form, it is extremely difficult to obtain a population estimate by direct observation.

The number of days by which desiccation or drying may shorten the period between physiological maturity and harvest maturity (D^n) in a sunflower crop depends on two important factors; (i) moisture content of seed when desiccated, or moisture content of the seed when harvested to be dried, and (ii) general weather conditions during the drying-down period.

To achieve the earliest possible harvest using desiccation, the chemical must be applied soon after the sunflower reaches physiological maturity, at moisture levels of 30 — 40% (Barrett, 1978; Dale, 1980). If chemical desiccants are applied when the moisture level has fallen below this level, their effectiveness in allowing an earlier harvest diminishes rapidly. There is no reported yield difference produced when sunflower is desiccated at 30 — 40% seed moisture (Degtyarenko, 1976; Palmer and Sanderson, 1976; Barrett, 1978), or any change in oil quality (Degtyarenko, 1976). Harvesting sunflower with high moisture often results in higher yields with less lodging, head-dropping and seed-shattering (Dale, 1980). For the earliest possible harvest using mechanical drying, sunflower should be harvested at 17% moisture (Dale, *pers. comm.* 1981).

Rain and especially cool autumn temperatures prolong the drying-down of sunflower. Depending primarily upon the time of year, mechanical drying and chemical desiccation may allow an earlier harvest by several weeks (see Table 1).

Table 1. The number of days by which mechanical drying and chemical desiccation can bring forward a harvest date. (Figures adapted from published results of desiccation tests — Barrett 1978).

Trial site and harvest date if sun-dried and harvested at 13% moisture		Mechanically dried, harvesting at 17% moisture (days earlier than sun-dried harvest)	Chemical desiccation and harvesting at 13% moisture (days earlier than sun-dried harvest)
Jan-Feb harvest spring sown			
Gravesend	Jan 29	5	7 (applied at 32.5% moisture)
M.I.A.	Feb 23	6	2 (applied too late at 18% moisture)
Mean		5.5	7
June harvest summer down			
Croppa Creek	June 29	28	19 (applied at 25% moisture)
Moree	June 25	9	17 (applied at 31% moisture)
Moree	July 1	13	17 (applied at 34% moisture)
Mean		17	18

Evaluation of desiccating and drying in reducing bird damage.

There are many variables in the equation for estimating the cost of bird damage which will allow tremendous latitude in the cost efficiency of alternatives. Therefore it is not possible to form generalities but each crop situation must be treated individually.

By assuming that the price of sunflower (S), is $250 per tonne and that bird flocks are composed of equal numbers of galahs and cockatoos, then significant relationships between bird numbers and cost of damage become apparent (see Figure 1).

Mechanical drying costs between $2 and $10 per tonne of seed depending on the moisture and quantity of the seed to be dried and whether the drier is owned by the farmer whose seed is to be dried.

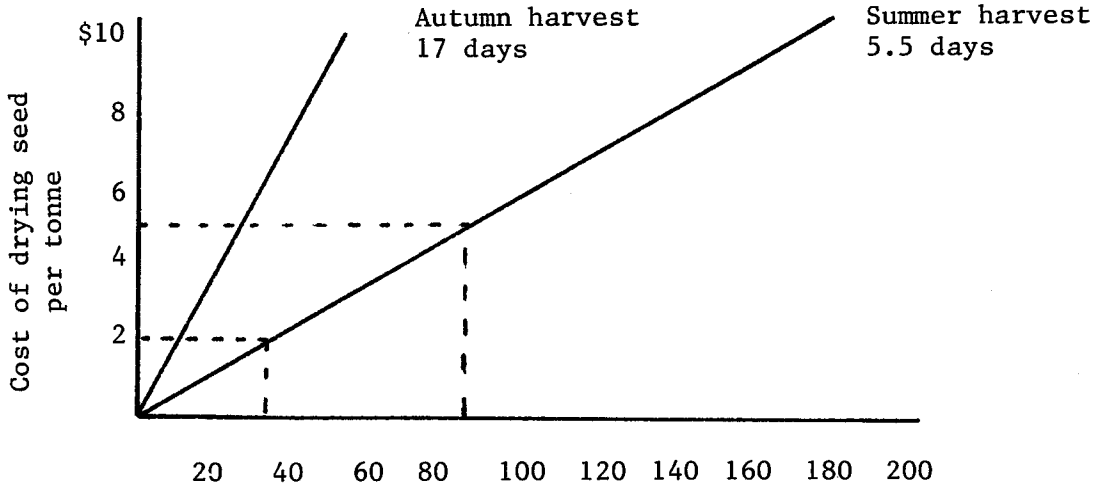

Figure 1. Number of birds necesary to economically justify drying costs for summer and winter harvests to reduce the period of crop susceptability to birds.

This graph indicates that in a summer harvest, mechanical drying at $2 per tonne becomes economical if more than 33 birds per tonne of seed to be dried are feeding on the crop per day. If however, drying costs are $5 per tonne then a bird density in excess of 80 birds per day, per tonne of seed to be dried will be necessary before this method could be economically justified as a technique for reducing bird damage.

During the cooler autumn months when drying can allow an earlier harvest of approximately 17 days, drying becomes economical when feeding birds exceed a density of 10 — 50 birds per day, per tonne of seed to be dried. The variation, (10 to 50) depends on the cost of drying seed.

The cost of chemical desiccation per hectare varies according to acreage and rate of applications, but generally ranges from $22 — $29 per hectare (*pers.comm.* J. Goddard, aerial spraying contractors, Gunnedah). Apart from the advantages of a quick dry-down, chemical desiccation appears to produce a marginal increase of up to 1.5%, in oil content. For desiccation to be viable as a means of reducing the period of susceptibility, the cost of bird damage must exceed the cost of desiccation. In summer there would need to

be a bird density in excess of 270 to 350 birds per hectare, per day, feeding on the crop. (see Figure 2). In autumn bird density has to exceed approximately 100 to 150 birds per hectare per day to make desiccating economically justified.

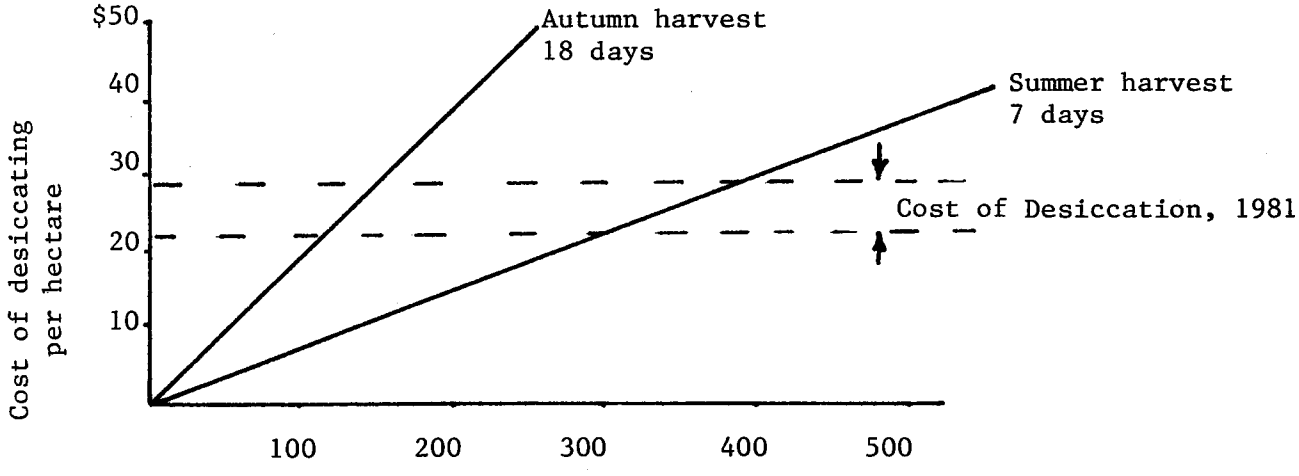

Figure 2. Cost of bird damage to sunflower during a 7 and 18 day period, the period of time by which chemical desiccation may allow an earlier harvest in summer and autumn respectively.

DISCUSSION

From this analysis it is evident that for early sown sunflower, harvested under normal summer weather conditions, chemical desiccation in not economically justified for reducing the cost of bird damage unless the density of galahs and cockatoos feeding on the crop exceeds approximately 300 birds per hectare per day. However in late-sown crops, experiencing very large bird-numbers of approximately 50 — 150 birds per hectare per day, desiccation and drying may be economically viable and worth considering.

The marginal reduction in bird damage costs achieved by these techniques could possibly be duplicated by other, less expensive forms of bird control. The estimates used in this analysis for the amount of seed eaten, per day, per bird from Broome *et al.,* (1979), were recorded in a sunflower crop situation where there was no effort made to discourage birds. Under normal conditions, where considerable effort is taken to reduce bird damage by shooting, scareguns, recorded distress calls etc., it could be expected that birds would eat and destroy less (per bird, per day) than the estimates used. Thus the alternatives of drying and desiccating would be less economic than indicated.

Mechanical drying appears to be a more economically efficient technique for alleviating bird damage. However there are several practical problems in processing large volumes of sunflower seed through mechanical driers than reduce this apparent advantage.

Usually there are several factors affecting a farmer's decision to desiccate or dry seed in addition to the consideration of reducing bird damage. These additional advantages may be judged to be of such importance as to make a decision to desiccate on dry sunflower economical.

ACKNOWLEDGEMENTS

This analysis would not have been possible without the information of desiccation, (Barrett, 1978), and the estimates of the amount of seed eaten, per bird per day from Broome *et al.,* (1979). This information is gratefully acknowledged. Special thanks to Tony Dale (Agronomist Department of Agriculture) for supplying additional information. Research into bird-pests in sunflower has been supervised by Dr P.J. Jarman and funded by the Oilseeds Research Committee.

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