Hybrid Dahlia (*Dahlia hybrida* L.) Seed Production

A thesis presented in partial fulfilment

of the requirements for the Degree of Master

of Applied Science in Plant Science (Seed Technology)

at Massey University

New Zealand

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1996

ABSTRACT

Three experiments related to dahlia seed production were conducted at the Seed Technology Centre, Massey University, New Zealand in the 1995/1996 season, with the objectives being to: evaluate herbicide toxicity to dahlia; determine the effect of establishment method and plant density on dahlia seed yield and yield components; and determine the effect of sowing date on dahlia seed yield.

Thirteen herbicides applied pre-emergence or post-emergence were evaluated in the herbicide experiment. EPTC (4.32 kg a.i/ha), oxyfluorfen (0.72 kg a.i/ha), oryzalin (4.5 kg a.i/ha), oxadiazon (1.52 kg a.i/ha), simazine (1.0 kg a.i/ha) and terbacil (0.96 kg a.i/ha) all caused some injury to direct sown and transplanted dahlias, and can not therefore be used safely on the dahlia crop. Of the pre-emergence herbicides, alachlor (1.92 kg a.i/ha), chlorpropham (3.2 kg a.i/ha), chlorthal-dimethyl (7.5 kg a.i/ha), pendimethalin (1.32 kg a.i/ha) and trifluralin (1.2 kg a.i/ha) did not injure either direct-sown or transplanted plants. Methabenzthiazuron (1.05 kg a.i/ha) did inhibit the early growth of direct sown dahlia, but plants recovered very quickly. All five herbicides could be used as pre-emergence herbicides for dahlia, but on a cost and weed control spectrum basis, alachlor or trifluralin are recommended. Terbacil (0.96 kg a.i/ha), while not affecting transplanted seedlings did damage direct sown dahlia, and should only be used as a pre-emergence herbicide in transplanted dahlia.

From the post-emergence herbicides, chlorpropham (3.2 kg a.i/ha) did not injure either direct-sown or transplanted dahlia. Chlorthal-dimethyl (7.5 kg a.i/ha), haloxyfop (0.3 kg a.i/ha), and methabenzthiazuron (1.05 kg a.i/ha) caused some plant injury to early

growth of direct-sown seedlings, but injured plants recovered quickly. Therefore, these herbicides can be recommended for both direct-sown and transplanted dahlia when applied post-emergence. Of these, the cheapest is methabenzthiazuron, and on this basis it is recommended for use in dahlia post-emergence.

Method of establishment (transplanted seedlings or tubers) did not affect seed yield. Of five plant densities (0.8, 0.6, 0.4, 0.3 and 0.2 m square spacings), seed yield per square meter from a harvest when 80% of the seedheads had turned brown was greatest from the 0.4 m square spacing (12.3 g/m^2). However, when seedheads were harvested as they ripened (i.e. over several weeks), the highest yield was at the 0.3 m square spacing (15.97 g/m^2). Individual plant yield was highest (4.49 g/plant) at the lowest density (0.8 m square spacing), and the lowest (0.105 g/plant) at the highest density (0.2 m square spacing). Seedheads per plant contributed most to the differences, as more branches per plant at lower densities produced more seedheads per plant. Seed weight was slightly bigger at lower densities, while seed number per seedhead was greater at higher densities than at lower densities.

The feasibility of direct seed sowing for dahlia seed production was confirmed in Palmerston North, New Zealand. Sowing dates from 7 November to 5 December did not produce any difference in seed yield and yield components. However, a 19 December sowing produced a significantly lower seed yield per plant, seedheads per plant and thousand seed weight. Later sowing delayed flowering time, shortened flowering duration and made seedheads ripen later. All sowing were harvested after frosts, and the seedheads in the latest sowing were very immature when harvested. In this environment, seed showed not be sown later than 7 November.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks and gratitude to all the staff and students of the Seed Technology Centre, Massey University, for their assistance throughout the course of my study.

I wish to express my deep gratitude to my chief supervisor, Associate Professor John G. Hampton, for his guidance, helpfulness, encouragement and support throughout my study, particularly for his constructive criticism and patient correction of my thesis. Without his help, this work would not have been possible.

My sincere thanks and gratitude also to Professor Murray J. Hill, my second supervisor, for his guidance and support throughout my study.

I would also like to give my thanks to Dr. Kerry Harington for his guidance and supplying herbicides and for spraying equipment during my herbicide experiment.

Special thanks also are given to Mr. Craig MacGill for his help with my data processing and Mr. Robert Southward for providing dahlia seeds and tubers, and with help with my experimental work.

Finally, I would thank my family for their support during my study.

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GENERAL INTRODUCTION

The production of flower seed is an important part of the seed industry (Leslie and Leonard, 1954). However, the history of commercial flower seed production only goes back to the second half of the last century when seed companies in Germany, France, UK, and later in the Netherlands, started the growing and marketing of some flower seed species, in addition to their production and commercialisation of vegetable seed. The major expansion occurred in the 1930s (Vis, 1980), but always in the regions with the most suitable climate and soil conditions for particular species. Today, flower seeds are grown commercially in many different countries (Vis, 1980).

Flower seed production presents a number of problems not encountered by other crop seed growers. One of the big differences is that with many flower-seed crops, the quantity of seed required to satisfy the market demand is much less than the amount normally produced of even some minor vegetable crops. In some instances a few rows or a small block is sufficient. It may not be necessary to produce every flower item each year; instead it may be more feasible, in those crops which retain their viability over a fairly long period, to grow enough seed one year to last for several years (Leslie and Leonard, 1954).

Seed yields per unit area for many species are quite low and hand-labour requirements are high. With some crops the total amount of seed handled is so small that the use of seed cleaning machines is impractical (Leslie and Leonard, 1954). The entire supply of certain items which a company produces may be no more than several kilograms, as commercial plantings of certain flower seeds are often less than one third of a hectare in size (Leslie and Leonard, 1954). Also, some flower seeds are so minute that they need to be cleaned by special methods. The industry as a whole has found that the growing of flower seed is frequently more exacting and expensive than is the growing of other crop seeds (Leslie and Leonard, 1954).

Since the turn of this century, the development of new flower varieties has been an important phase of the flower seedsman's business. By breeding and selection it has been possible to develop new attractive forms and colours of many flowers, and so increase the market demand for them (Leslie and Leonard, 1954).

Dahlias are popular in many parts of the world and used as garden plants, for borders, back ground exhibitions, and as cut flowers, bedding and potted plants because of their remarkable diversity of form, colour and size (Mastalerz, 1976; Phetpradap[1], 1992; De Hertogh and Le Nard, 1993). In Colombia, flower exports only began in the late 1960s, but by 1979, dahlia was 21% of export production (Palacios et al, 1979). The Netherlands is a major producer of tuberous-rooted dahlias. It produced 368 hectares in 1989. Japan produced 24 hectares in 1987 and France produced 55 hectares in 1990. Other countries such as Great Britain, Italy, South Africa, United States, and Germany also produced dahlias, but no areas were reported (De Hertogh and Le Nard, 1993).

Dahlia can be propagated by tuberous roots, plant cuttings or seeds to grow as bedding plants, garden plants, and cut flowers (Brondum and Heins, 1993). However, few dahlia producers appear to produce dahlia seeds commercially, even though seed propagation may be the cheapest option.

Little information exists for dahlia seed production. As for any seed production, agronomic management for flower seed production is also mainly related to plant density, fertilizer, weed control, pest and disease control and harvest. Flower seed production is more costly than field crop seed production, and the cost and labour expended on an inferior seed lot are almost equal to those expended on a good lot (Vis, 1980). More than 40% of the cost can be for field labour (Bodger, 1961). When or if the market growth slows, the key to profit will be volume sales and cost efficiency, rather than increasing price (Voigt, 1994). Thus, any technology which reduces energy consumption and labour costs, while maintaining higher productivity, has become the first priority. Many papers have been published on the production of agricultural and horticultural seeds, but comparatively few on flower seeds, due to the highly competitive nature of this business (Phetpradap[1], 1992), and the small size of commercial production.

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[1] refers S. Phetpradap

Weeds are always a problem for crop production. They can smother crops reducing yields (Vis, 1980). Traditionally, for flower seed crops, weed control has been a highly labour intensive operation because it often was by non-chemical methods (Stephens, 1982). Chemical weed control is now playing an important role (Vis, 1980) and may reduce the cost of weed control. However, the choice of herbicide for a particular situation will depend upon several variables including climate, soil type, prevalent weed species, crop cultivar and method of propagation and management (Stephens, 1982).

The potential herbicide damage to crops strongly concerns farmers. "If we think we are going to damage the crop by spraying, we don't. If we feel the conditions are not correct for a chemical to work, we don't. If we feel we have to apply a herbicide that may damage the crop to the detriment of yield, just to make the crop look pretty, we try not." said Forsyth (1983). Therefore, it is not sufficient to carry out trials which demonstrate that by removing weed populations crop yields are increased. Such results could well hide an adverse effect of the herbicide on the crop, which would be manifest if weeds were absent or at such low numbers that the presence of the weeds was not affecting crop yields (Caldicott, 1983). Also, in many cases a reasonably low weed density does not require any herbicide at all in terms of return of value in crop yield (Scarr, 1983).

Although the manufacturers have described which herbicides can kill what weeds, it is still difficult to determine whether herbicides can be used on a specific species under certain conditions without damaging crops. Few papers have been published on herbicide application to dahlia, perhaps due to the highly competitive nature of this business, or probably because the industry is too small to attract this type of work.

This project concentrates on some of factors which affect the commercial production of dahlia seeds. Although some aspects of the agronomic management of dahlia have been studied by previous researchers, there is little information about the production of dahlia seed on a commercial scale. There are many agronomic management gaps for commercial dahlia seed production. For instance, plant density is a very important factor affecting seed yield and quality, but there is limited information on the effects of density on dahlia seed production. Conventionally, dahlias are grown from stem cuttings and tuber division to produce cut flowers, bedding and garden plants, and seeds, which are relatively expensive methods compared with growing from seeds. But few growers grow dahlia from seeds or seedlings. Herbicides, as a primary method for controlling weeds are available for many crops. Very little information, however, exists about their application for dahlias. Therefore the research objectives were:

1. To determine the effect of plant density on dahlia seed yield in both tuber to seed and seedling to seed production systems.
2 To determine the optimum sowing date for seed production in the Manawatu environment in a direct sowing system.
3. To determine whether selective herbicides are toxic to dahlia plants when grown under transplanted seedlings-to-seed, and seed-to-seed systems, and to therefore determine which herbicides are potentially usable for dahlia seed production.