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SESAME RESEARCH REPORT 1993-94 WET SEASON KATHERINE

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1993-94 WET SEASON

KATHERINE

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SUSTAINABLE AGRICULTURE

THE DEPARTMENT OF PRIMARY INDUSTRY AND FISHERIES IS COMMITTED TO THE PRINCIPLES AND PRACTICES OF SUSTAINABLE AGRICULTURE

Definition:

Sustainable agriculture is the use of practices and systems which maintain or enhance:

- the economic viability of agricultural production:
- the natural resource base: and
- other ecosystems which are influenced by agricultural activities.

Principles:

1. Agricultural productivity is sustained or enhanced over the long term.
2. Adverse impacts on the natural resource base of agricultural and associated ecosystems are ameliorated, minimised or avoided.
3. Harmful residues resulting from the use of chemicals for agriculture are minimised.
4. The nett social benefit (in both dollar and non-dollar terms) derived from agriculture is maximised.
5. Agricultural systems are sufficiently flexible to manage risks associated with the vagaries of climate and markets.

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1. Introduction

There has been substantial research in identifying crops which are possible alternatives to maize, soybean, mungbeans and sorghum for the Northern Territory.

One crop that has shown potential for the Katherine region is sesame. Intensive research with sesame was initiated in the 1987-88 wet season. Research since then has included cultivar, sowing date, population, crop establishment, nutrition, weed control, disease monitoring, harvesting and seed maintenance experiments. Development of pure cv. Yori 77 seed and an improved cultivar for northern Australia has been given the highest priority. This research was jointly funded by Grains Research and Development Corporation and Rural Industries Research and Development Corporation.

A superior sesame genotype (Y1:44) was selected in 1992-93 (Bennett and Martin, 1993). Seed multiplication and demonstration areas of the new genotype were sown this year. Significant differences in plant morphology between the commercial cultiver and Y1.44, and farmer adoption of zero tillage technology has highlighted the need to re-assess some agronomic practices, eg. row spacing by population interactions for sesame.

2. General Methods

2.1 *Sites and Soils*

This year's experiments were undertaken at Katherine Research Station (14^0 28'S, 132^0 18'E) and Douglas Daly Research Farm (13^0 51'S, 132^0 12'E). The soil type used at Katherine was a Fenton clay loam, (Lucas *et al.* 1985) while a virgin Venn sandy loam was used at Douglas Daly. Soil fertility analysis is presented in Table 2.1.

A plant population observation experiment was located in a commercial sesame crop on Garibaldi (approximately 2 km SW of DDRF). The soil type was a Fenton clay loam.

2.2 *Seasonal Conditions*

At Douglas Daly and Katherine, the 1993-94 wet season was characterised by very good land preparation rains in November and December. Suitable sowing rains and follow-up rains occurred in January. The wet season finished in the middle of March.

Total rainfall for November '93 to May '94 at Douglas Daly and Katherine was 1123 mm and 1025 mm respectively (Table 2.2).

2.3 *Land Preparation and Weed Control*

Unless otherwise mentioned both research sites were conventionally prepared in December, while any weed regrowth was controlled with an application of Round-up CT® @ 2.0 L/ha.

At Douglas Daly no herbicide was applied while at Katherine, Dual® @ 1.5 L/ha was sprayed on 6 January. Soil physical condition at Katherine was moist at the time of herbicide application.

Land preparation, weed control and fertiliser applications for the population experiment in the Garibaldi sesame crop are detailed in 'Effect of plant population on sesame seed yield'.

2.4 *Fertiliser Application*

Basal fertiliser applications are detailed in Table 2.3.

2.5 *Insect Control*

Douglas Daly Research Farm
Antigastra catalaunalis caterpillars were identified but numbers did not warrant their control.

Garibaldi
Soldier Fly larva were identified in large numbers but did not warrant control.

Katherine
Antigastra catalaunalis caterpillars were sprayed on 12 January and 20 January with Endosulphan @ 2.1 L/ha.

2.6 *Irrigation*
Supplementary irrigation (9 mm per application) was applied to the genotype evaluation and row spacing experiments on the 25 January and 2 February.

Table 2.1 Soil nutrient status at Katherine and Douglas Daly

Soil analysis	Katherine 0-15cm		Douglas Daly		
	H8	H9	0-15cm	15-30cm	30-60cm
Cond (ms/cm)	0.05	0.09	0.05	0.04	0.05
pH	6.2	6.5	8.0	7.3	6.9
Avail. P (ppm)	5	10	5	<5	<5
Avail. K (ppm)	300	290	60	50	80
Avail. Ca (ppm)	860	930	640	330	400
Avail. Mg (ppm)	210	290	80	60	70
Avail. S (ppm)	7	9	4	4	3
Avail. Cu (ppm)	2.5	2.4	0.3	0.4	<0.3
Avail. Zn (ppm)	0.6	0.7	0.1	< 0.1	0.2
Avail. Mn (ppm)	17	16	23	26	24
Avail. B (ppm)	0.3	<0.2	< 0.2	< 0.2	< 0.2
Total N (%)	0.12	0.11			

Table 2.2 Rainfall, pan evaporation, radiation and mean temperatures at Katherine and Douglas Daly in 1993-94 wet season

	Nov	Dec	Jan	Feb	Mar	Apr	May	
Monthly rainfall (mm)								**Total**
Douglas Daly	124.5	337.1	146.5	216.8	293.8	4.4	0.0	1123.1
Katherine	88.3	345.7	154.4	169.3	260.6	7.0	0.0	1025.3
Mean (1)	108.5	142.9	269.2	303.2	253.6	46.6	7.5	1131.5
Mean (2)	83.3	191.6	228.6	210.2	162.7	32.8	5.1	914.3
Mean maximum daily temperature (^{0}C)								
Douglas Daly	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
Katherine	38.2	35.6	35.3	34.0	33.7	33.6	32.4	
Mean (1)	36.6	35.3	33.6	32.9	33.2	33.4	32.0	
Mean (2)	37.8	36.2	34.6	34.1	34.3	33.9	32.0	
Mean minimum daily temperature (^{0}C)								
Douglas Daly	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
Katherine	24.4	24.4	23.7	23.5	20.3	16.7	13.8	
Mean (1)	24.2	24.0	23.7	23.7	23.0	20.6	17.1	
Mean (2)	24.3	23.9	23.7	23.4	22.3	19.5	16.2	
Mean daily radiation (MJ/m^2)								
Douglas Daly	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
Katherine	23.3	21.8	24.7	19.7	22.7	21..5	20.0	
Mean (1)	24.5	24.2	22.4	21.4	21.7	22.6	21.1	
Mean (2)	24.6	24.2	21.9	22.5	21.7	21.7	22.0	
Mean monthly evaporation (mm)								
Douglas Daly	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
Katherine*	249	216	190	151	171	180	182	
Mean (1)	252	226	168	146	N.A.	231	208	
Mean (2)	275	242	194	156	173	186	180	

* estimate as some values were missing
N.A. Not available
(1) Douglas Daly (2) Katherine

Table 2.3 Basal fertiliser applications

Experiment	Fertiliser	Rate	Application date
Row Spacing [1]	19:13	155 kg/ha (30 kg N/ha, 20 kg P/ha)	13 December
	Urea	130 kg/ha (60 kg N/ha)	14 December
	Sulphate of Ammonia	98 kg/ha (20 kg N/ha)	21 January
Genotype [1]	19:13	155 kg/ha	23 December
	Urea	130 kg/ha	29 December
Desiccation [2]	19:13	155 kg/ha	7 January
	Urea	45 kg/ha (21 kg N/ha)	12 January
Phosphorus * Potassium[3]	19:13	155 kg/ha	13 January

1 Location : Paddock H9, KRS
2 Location : Paddock H8, KRS
3 Location : Paddock 56, DDRF

3. Evaluation of sesame genotypes in the 1993-94 wet season

Introduction

A range of sesame genotypes were evaluated at Katherine Research Station in the 1993-94 wet season. This information is to be the basis for a plant variety rights application for Y1:44.

Major differences in phenology, node of lowest flower scar, nectary development branching habit, and seed weight could be used to identify the various genotypes. This evaluation will be repeated to insure all sesame genotypes are stable.

Materials and Methods

Design, treatments and management

Experimental design was a randomised complete block with 3 replications of 4 genotypes. Genotypes were Hnan Dun, 339, Y1:44 and Yori 77. Plot size was 2 rows x 20.0 m with a row spacing of 32 cm. Plots were sown 32 cm apart.

The experiment was sown by a 8 row cone-seeder under zero-till conditions on the 30 December 1993. Site preparation included mulching on the 22 December and spraying with Round-up CT @ 2.0 L/ha on the 29 December. All seed was treated with Lorsban 25WC @ 160 g/100 kg seed to prevent false wire worm damage. A observation area of cv. Turen was sown adjacent to these plots.

Plants were thinned to an intra-row spacing of 10 cm (equivalent to 300 000 plants/ha) 11 DAS.

Recordings and data collection

During the season various plant characteristics were measured. These characteristics are listed in Table 3.1. At 47 DAS and 71 DAS, 5 plants were selected from the end of each plot from one replication and the following measured;

a. Plant height
b. Number of branches
c. Number of capsules
d. Leaf area
e. Leaf weight (oven dry)
f. Stem weight (oven dry)
g. Capsule weight (oven dry)

Results and Discussion

A Plant characteristics for sesame genotypes evaluated are presented in Table 3.2.

Points of interest are as follows:

1. Both Yori 77 and Y1:44 recorded similar dates to anthesis, however Y1:44 flowered at a lower node.

2. Y1:44 reached physiological maturity one week later than Yori 77.

3. Y1:44 exhibited a non-branching habit while Yori 77 was a branching plant type.

4. Y1:44 produced larger seed then Yori 77.

B. Measurements of plant morphology at 47 DAS and 71 DAS are presented in Tables 3.3 and 3.4.

Points of interest are as follows:

1. 339 rapidly developed on a large number of leaves by 47 DAS but only minimal leaf area.

2. Y1:44 was slower in developing capsule biomass than the other sesame genotypes even though they recorded similar capsule numbers at 71 DAS.

C. General observations are highlighted in Table 3.5.

Important points are as follows:

1. 339 is either very susceptible to *Macrophomina* or the seed used for sowing was heavily inoculated with the fungus before arriving in the Northern Territory.

2. There were only 2 rainfall events after the 11 March (71 DAS), 0.8 mm on 28 March (88 DAS) and 7.0 mm on 7 April (98 DAS). These events were sufficient to result in seed sprouting in the capsules of Yori 77 (9% of plants) as compare to < 1% plants in Y1:44.

Table 3.1 Plant characteristics measured for sesame genotypes at Katherine.

Characteristic	**Comment**
Cotyledon colour	1 week after emergence
Cotyledon form	1 week after emergence
Cotyledon insertion	1 week after emergence
Plant pigmentation	At flowering
Stem hairiness	At flowering
Stem cross section	At harvest
Branching habit	At harvest
Number of branches	At harvest (includes primary and secondary development)
Leaf phyllotaxy	At flowering
Basal leaf margin	At flowering
Basal leaf form	At flowering
Angle between petiole and stem	5 or 6th leaf position
Leaf shape	At flowering, 5 or 6th leaf position
Leaf length	At flowering, 5 or 6th leaf position
Leaf width	At flowering, 5 or 6th leaf position
Petiole length	At flowering, 5 or 6th leaf position
Leaf venation	5 or 6th leaf position
Corolla colour	At flowering
Corolla hairiness	At flowering
Style length	At flowering
Extra - floral nectaries	At flowering
Flowers per leaf axil	At flowering
Days to flower	At flowering
Days to maturity	98% capsules changed colour
Plant height at maturity	At harvest
Capsule shape	After harvest
Capsule hairiness	After harvest

Dry capsule colour	After harvest
Carpels per capsule	After harvest
Capsule dehiscence	After harvest
Capsule length	After harvest
Capsule width	After harvest
Node of lowest flower scar	After harvest
Testa colour	After threshing
Testa texture	After threshing
Seed length	After threshing
Seed width	After threshing
1000 seed weight	After threshing
Oil content of seed	After threshing
Protein content of seed	After threshing

Table 3.2 Plant characteristics for sesame genotypes at Katherine

	Genotype				
Characteristic	Y1:44	339	Yori 77	Hnan Dun	Turen
Cotyledon colour	green	green	green	green	green
Cotyledon form	flat	flat	flat	flat	flat
Cotyledon insertion	pedicellate	pedicellate	pedicellate	pedicellate	pedicellate
Plant pigmentation	normal green	normal green	normal green	normal green	normal green
Stem hairiness	hairy	very sparse	hairy	glabrous	hairy
Stem cross section	square	square	square	square	square
Branching habit	non branching	basal branching	basal branching	basal branching	non branching
Number of branches					
Mean	0.88	2.08	3.57	4.52	0.08
Range	6	10	9	21	4
Std. dev.	1.363	1.502	1.798	3.623	0.418
No. plants measured	200	200	200	188	200
Leaf phyllotaxy	opposite	opposite	opposite	opposite	opposite
Basal leaf margin	lobed	entire	lobed	lobed or entire	entire
Basal leaf form	flat	flat	flat	flat	flat
Angle between petiole and stem	acute	horizontal	acute	horizontal	acute
Leaf shape	See photographs				
Leaf length (mm)					
Mean	153.2	122.2	155.2	126.4	119.1
Range	133	109	173	136	131
Std. dev.	26.14	17.91	25.18	23.20	19.77
No. leaves measured	400	400	400	376	400
Leaf width (mm)					
Mean	163.8	83.1	158.8	97.5	97.8
Range	228	112	258	136	181
Std. dev.	40.19	22.52	37.80	30.54	26.21
No. leaves measured	400	400	400	376	400

Characteristic	Genotype Y1:44	339	Yori 77	Hnan Dun	Turen
Petiole length (mm)					
Mean	140.0	62.5	117.2	73.8	74.1
Range	160	99	185	125	144
Std. dev.	31.02	17.99	26.00	25.25	20.39
No. measured	400	400	400	376	400
Leaf veneration	recessed	recessed	recessed	recessed	recessed
Corolla colour	All white with a violet tinge				
Corolla hairiness	very hairy	<hairy	hairy	hairy	<hairy
Style length	enclosed	enclosed	enclosed	enclosed	enclosed
Extra-floral nectaries	rudimentary	developed	rudimentary	developed	rudimentary
Flowers per leaf axil	3	1	3	1	3
Days to flower (DAS)					
Mean	39.0	31.7	38.5	32.8	32.7
Range	12	8	9	15	7
Std. dev.	2.51	1.49	1.71	2.25	1.42
No measured	200	200	200	188	200
Days to maturity (DAS)					
Mean	106.7	82.4	97.3	96.6	93.0
Range	30	29	24	28	17
Std. dev.	6.00	6.97	5.48	7.66	4.54
No. measured	200	200	200	188	200
Plant height at maturity (cm)					
Mean	159.9	131.9	148.9	132.5	128.1
Range	86	107	85	150	78
Std. dev.	15.73	15.61	11.3	27.37	13.21
No. measured	200	200	200	188	200

Characteristic	Genotype Y1:44	339	Yori 77	Hnan Dun	Turen
Node of lowest flower scar					
Mean	7.0	5.6	8.8	6.1	5.7
Range	5	4	4	6	5
Std. dev.	0.83	0.70	0.61	1.28	0.64
No. measured	200	200	200	188	200
Capsule shape	narrow oblong	narrow oblong	narrow oblong	narrow oblong	narrow oblong
Capsule hairiness	very profuse	less profuse	profuse	profuse	profuse
Dry capsule colour	brown	brown	brown	brown	brown
RHS code	165C	159A	165D	165D	165B
Carpels per capsule	2	2	2	2	2
Capsule length (mm)					
Mean	25.9	30.0	23.8	29.3	24.7
Range	8	13	8	8	9
Std. dev.	1.46	2.62	1.68	1.75	2.02
No. measured	100	100	100	100	100
Capsule width (mm)					
Mean	5.1	4.6	5.5	6.4	6.3
Range	1.0	3.4	3.0	3.5	3.0
Std. dev.	0.18	0.91	0.47	0.82	0.70
No. measured	100	100	100	100	100
Testa colour	cream	white	white	white and grey	white
RHS code	159B	159C	159C	159C & 197B	159B
Testa texture	smooth	smooth	smooth	smooth	smooth
Seed length (mm)					
Mean	3.2	3.1	3.1	3.2	2.9
Range	0.67	1.34	0.87	0.66	1.00
Std. dev.	0.130	0.141	0.154	0.564	0.153
No. measured	400	400	400	400	400

Characteristic	Genotype Y1:44	339	Yori 77	Hnan Dun	Turen
Seed width (mm)					
Mean	2.1	2.0	2.1	2.0	1.8
Range	0.67	0.67	0.65	0.80	0.66
Std. dev.	0.117	0.118	0.123	0.111	0.007
No. measured	400	400	400	400	400
Weight of 1000 seeds (g)	3.58	3.27	3.03	3.11	2.59
Oil content of seed (%)	58.6	56.1	58.9	56.6	56.2
Protein content of seed (%)	20.9	23.9	18.9	23.1	22.7

Table 3.3 Plant morphology at 47 DAS for sesame genotypes at Katherine

Characteristic	Genotype[1] Y1:44	339	Yori 77	Hnan Dun	Turen
Plant height (cm)	107.5	119.2	108.4	N.A.	120.2
Branch number	0.0	3.4	2.2	N.A.	0.2
Capsule number	2.2	28.2	2.0	N.A.	19.6
Leaf number	12.8	36.0	18.4	N.A.	15.8
Leaf area (cm^2)	976	785	1091	N.A.	641
Leaf weight (g)	5.7	4.6	5.4	N.A.	4.2
Stem weight (g)	15.5	9.2	8.7	N.A.	7.8
Capsule weight (g)	0.1	4.0	0.1	N.A.	1.7
Total weight (g)	21.3	17.8	14.2	N.A	13.7

1 Mean for 5 plants, oven dry weights.
N.A. not available = data lost.

Table 3.4 Plant morphology at 71 DAS for sesame genotypes at Katherine

	Genotype				
Characteristic	Y1:44	339	Yori 77	Hnan Dun	Turen
Plant height (cm)	151.4	126.6	155.2	138.2	143.8
Branch number	0.2	2.0	2.0	3.4	0.4
Capsule number	57.4	51.6	120.6	54.4	56.4
Leaf number	64.0	76.8	119.8	107.8	36.8
Leaf area (cm^2)	1750	854	2297	1050	756
Leaf weight (g)	34.3	19.5	48.8	29.5	18.0
Stem weight (g)	73.7	56.9	103.8	73.6	57.3
Capsule weight (g)	49.2	81.7	90.9	68.3	61.8
Total weight (g)	157.2	158.1	243.5	171.4	137.1

1 Mean for 5 plants, oven dry weights.

Table 3.5 Observations of sesame genotypes at Katherine

	Genotype				
Characteristic	Y1:44	339	Yori 77	Hnan Dun	Turen
No. plants measured	200	200	200	188	200
Susceptible to - *Macrophomina*	10	157	34	7	2
- Sprouting seed in capsule	1	Nil	18	Nil	4

Figure 3.1 Leaf shape at node 6 for Y1:44

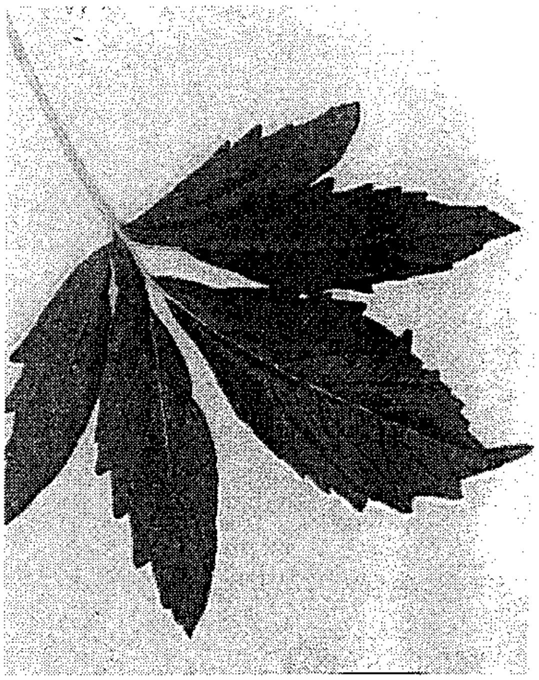


Figure 3.2 Leaf shape at node 6 for 339

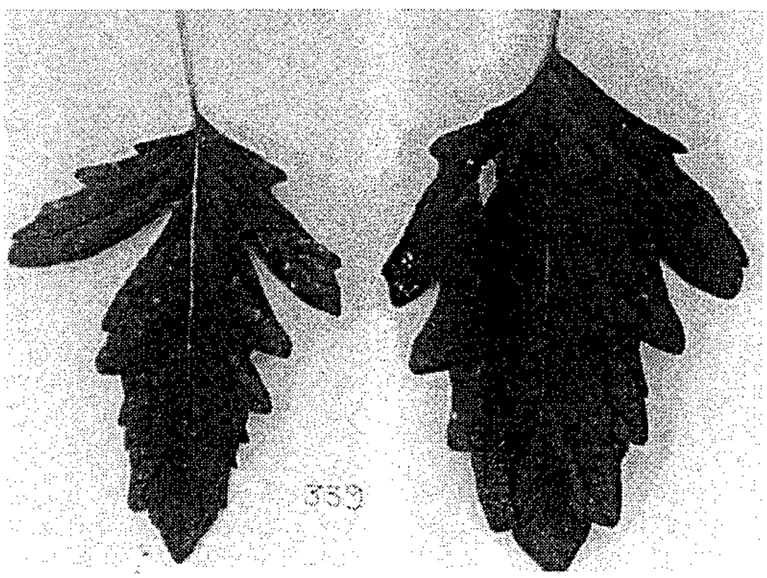


Figure 3.3 Leaf shape at node 6 for Yori 77

Figure 3.4 Leaf shape at node 6 for Hnan Dun

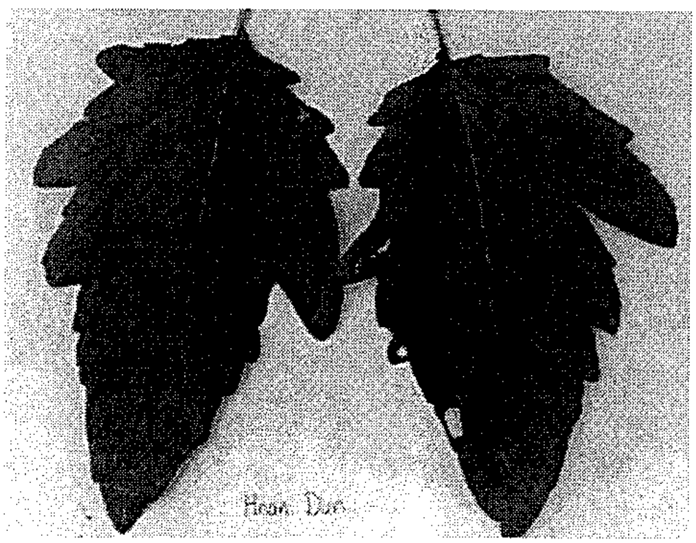
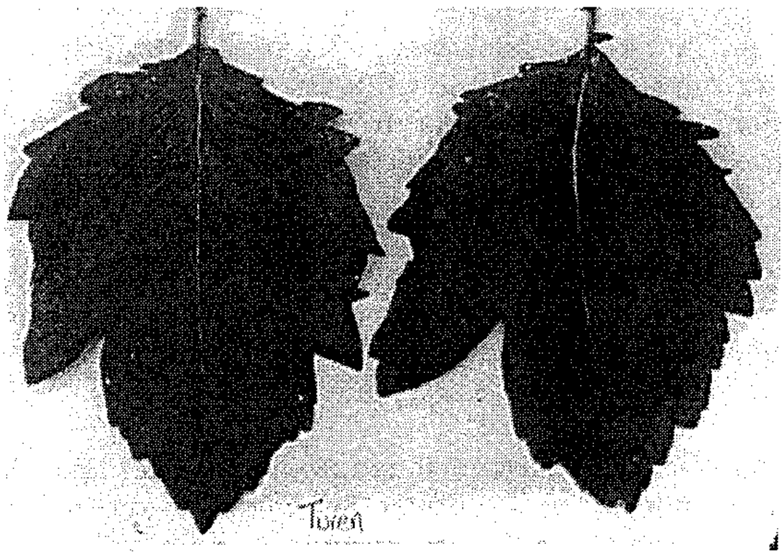


Figure 3.5 Leaf shape at node 6 for Turen



4. Effect of time and rate of Reglone application on desiccation of sesame.

Introduction

A major problem in the establishment of a sesame industry in the Northern Territory is that the current sesame cultivars are dehiscent plant types, that is the capsules dehisce as the crop matures. This plus the extended period of capsule maturation results in considerable seed losses prior to and during harvesting.

Research last year indicated that a sesame crop allowed to naturally hay-off was ready to harvest when >95% were brown and open. At this stage capsule moisture content was 10% or less. Harvesting then prevented tainting of the sesame seed by sap extract from the capsule and stem.

The use of Reglone® as a desiccant to reduce pre-harvest losses by reducing the period of capsule maturation has been effective for the Queensland sesame industry. In the NT the application of Reglone could reduce the time of exposure to shattering losses by 10-14 days. This experiment investigates rates and times of Reglone®application while monitoring seed losses and seed quality aspects of the new sesame genotype (Y1:44).

Materials and Methods

Design, treatments and management

Experimental design was a randomised complete block with a factorial combination of 4 rates and 4 times of Reglone® (Diquat 200 g/l) application. Rates and times of application are presented in Table 4.1. There were 4 replications.

Plot size was 7 rows x 10.0 m with 32 cm row spacing. Sesame genotype Y1:44 was sown with a small plot combine. Plants were thinned to an intra-row spacing of 15 cm (equivalent to 200 000 plants / ha) approximately 17 DAS.

Recordings and data collection

The following procedure was implemented at 97 DAS and repeated approximately every 3 days for all plots.

a) 3 representative plants were sampled from the end of the middle 2 rows of each plot.

b) Number and morphological condition of the capsules was recorded. Capsules were divided into 5 categories.

1 - green capsules, closed capsule apex
2 - yellow - green capsules, closed capsule apex
3 - yellow capsules, closed capsule apex
4 - brown capsules, closed capsule apex
5 - brown capsules, open capsule apex

Only capsules greater than 15 mm in length were considered.

c) Plants were then partitioned into stem and capsules for moisture content determinations.

d) Two trays (each 1.20 m * 0.25 m) were inserted into each plot (location fixed) to measure shattering losses. Seed collected in these trays was measured on the same day as plant sampling .

Potential harvestable seed yield and plant number were measured on the 103, 112, 118 and 129 DAS by harvesting 5 rows * 0.7 m. Seed collected at 129 DAS was used to determine seed quality, that is 1000 seed weight, germination percentage, oil content and free fatty acid content.

Results

Mean plant population

Mean plant populations for all sampling dates was 219 000 plants / ha (Table 4.2). There was no significant differences between treatments.

Plant population, potential harvestable seed yield and accumulative seed losses for the no desiccant plots.

Mean plant populations for plots not treated with Reglone® was 216 000 plants/ha. Potential harvestable seed yield at 97 DAS was approximately 400 kg/ha less than for later harvesting dates, while pre-harvest seed losses were 14.7% of total seed yield. Mean total seed yield was 1987 kg/ha, (Table 4.3).

Crop morphology

Natural dry-down of sesame plants

Morphological and moisture curves are presented in Figures 4.1 and 4.2 respectively.

Physiological maturity (95% capsules have changed colour from green) occurred at 106 DAS. Capsule moisture content at this time was 121% while stem moisture content was 222%. Harvest maturity (>95% capsule brown) occurred at 116 DAS, however capsule moisture content was high (19% at 115 DAS). Capsule moisture content continued to decrease to 10% by approximately 119 DAS.

Moisture content of the sesame stem was always higher than that of the capsules though they approach equivalent moisture contents by 125 DAS.

Desiccation at 97 DAS

Morphological and moisture curves are presented in Figures 4.3a, 4.3b, 4.3c, 4.3d, 4.4a and 4.4b respectively.

At 97 DAS, 44% of capsules were green and 41% of capsules were yellow-green while their moisture content was 214%. Moisture content of the stem was 331%. Six days after spraying 97% of capsules had changed colour as opposed to 83% of capsules for the no Reglone®- 97 DAS treatment. Moisture content of the capsules varied according to rate of Reglone application, the higher the rate of chemical application the lower the moisture content of the capsule.

Capsules reached 10% moisture by approx. 107 DAS, 110 DAS, 119 DAS and 119 DAS for the 5.3 l/ha, 2.6 l/ha, 1.4 l/ha and then no Reglone treatment respectively.

Desiccation at 103 DAS

Morphological and moisture curves are presented in Figures 4.5a, 4.5b, 4.5c, 4.5d 4.6a and 4.6b respectively.

At 103 DAS, 30% of capsules were green and 53 % of capsules were yellow-green while their moisture content was 150%. Moisture content of the stem is 236%. Six days after spraying >96% of capsule were brown in the chemically treated plots where as only 79% capsules were brown in the no Reglone plots. Capsule moisture content in the no Reglone® plots was 40% while it ranged between 17% and 14% for the chemically treated plots. Capsules in the sprayed plots reached 10% moisture content 3 days later (112 DAS) while capsules in the control plots did not reach 10% moisture until 121 DAS.

Desiccation at 109 DAS

Morphological and moisture curves are presented in Figures 4.7a, 4.7b, 4.7c, 4.7d and 4.8a and 4.8b respectively.

At 109 DAS there were no green capsules, 14% of capsules were yellow-green and 68% capsules were brown and open. Moisture content of capsules and stem was 99% and 116% respectively. Six days after spraying all capsules were brown in all the chemically treated plots whereas only 93% capsules were brown in the no Reglone® plots. Capsule moisture content in the no Reglone® plots was 27% while in the chemically treated plots it was 10%. Capsules in the no Reglone plots reached 10% moisture at 117 DAS.

<u>Seed losses</u>

Accumulative seed losses
Accumulative seed losses are presented in Table 4.4.

Accumulative seed losses between 11 April (94 DAS) and 16 May (129 DAS) for all plots was 295 kg/ha. There was no significant difference between treatments (Table 4.5). This means whether the crop is desiccated or not, if the crop is not harvested at the correct time accumulative seed losses will always be high.

Accumulative seed losses at 10% moisture content for capsules is presented in Table 4.6.

Mean accumulative seed loss for sesame plots not desiccated was 225 kg/ha at 119 DAS while the rate of seed loss between 94 DAS and 119 DAS was 9.0 kg/ha/day.

Seed losses for 97 DAS desiccation

Rate of Reglone® application significantly affected the time of harvesting. The higher the application rate the earlier the harvest date and therefore the shorter the duration of exposure to seed shattering losses. Note, an application rate of 1.4 l/ha was not effective as a desiccant when applied at 97 DAS ie. time to harvest was not shortened by an application of 1.4 l /ha of Reglone®. Pre-harvest shattering losses were reduced from 225 kg/ha to 106 kg/ha (5.3 l/ha of Reglone®) by desiccation.

Seed losses for 103 DAS desiccation

Application of Reglone® significantly reduced time to harvest by 7 days, however there was no difference in harvest date between the various rates of Reglone® application. Pre-harvest seed losses were reduced from 225 kg/ha to 155 kg/ha (5.3 L/ha of Reglone®) by desiccation.

Seed losses of 109 DAS desiccation

Application of Reglone® reduced time to harvest by 4 days. There was no difference in harvest date between the various rates of Reglone® application. Pre-harvest seed losses were reduced from 225 kg/ha to 218 kg/ha (5.3 l/ha of Reglone®.

Seed quality

Applying desiccants as early as 97 DAS (40% capsules green) did not effect seed quality. Mean seed weight, oil content and level of free fatty acid was 3.55 g per 1000 seed, 56.9% and 0.5% free fatty acid (Table 4.7).

Discussion

The cost of aerial applying Reglone® as a desiccant is $27/l/ha. The chemical costs $15/l and spraying cost $12/ha, ferrying fee for the aircraft is variable depending on location of the farm.

If value of sesame grain is $1.2 /kg then the farmer needs to recover 22.5 kg/ha per litre of Reglone® applied per hectare.

Desiccating sesame genotype Y1:44 resulted in additional grain being harvested by the farmer, however only the application of 2.6 l/ha of Reglone® at 97 DAS (40% capsules green) was cost effective (a profit of $30/ha). The value of additional grain harvested through desiccation is presented in Table 4.8.

Desiccation has a further advantage of being a risk management tool. Sesame naturally drying-down is exposed for 30-40 days to end of season storms while a desiccated sesame crop has a dry-down period of 7-10 days and usually desiccation is timed to minimise exposure to storms, as well as allowing the farmer to schedule events such as contract harvesting and delivery of grain to the depot.

This year Reglone® was applied to a commercial sesame crop (cv. Yori 77, 98% capsules yellow) at Garibaldi. Total seed losses were 11% of potential seed yield as compared to the usual 30% experienced by the farmer for a naturally matured crops in previous years. The time allowed between spraying and harvesting was 7 days.

Further research into desiccation of sesame is required. Results indicate that application rates of 2.0 l/ha are cost effective and that time of application should be between 40% and 20% capsules green.

Table 4.1 Rates and times of Reglone® application

Rates of application	Time of application
0.0 L/ha	97 DAS (40% green capsules)
1.4 L/ha	103 DAS (18% green capsules)
2.6 L/ha	109 DAS (0% green capsules)
5.3 L/ha	not applied

Table 4.2 Mean plant population for all sampling dates

Plant population ($\times 10^3$/ha)					
Rate of Reglone® application (L/ha)	Application date (DAS)				
	97	103	109	not applied	Mean
No chemical	213	221	218	210	216
1.4 L/ha	228	216	221	217	221
2.6 L/ha	224	217	225	220	222
5.3 L/ha	214	217	224	214	217
Mean	220	218	222	215	219

Table 4.3 Crop characteristics for the no desiccant treatments.

	Sampling date (DAS)					
	97	103	112	118	129	Mean
Plant population ($\times 10^3$/ha)	194	211	220	207	249	216
Potential harvestable seed yield (kg/ha)	1409	1873	1721	1779	1901	-
Accumulative seed losses (kg/ha)	9	47	122	213	292	-
Total seed yield (kg/ha)	1418	1920	1843	1992	2193	1982
Preharvest seed losses (% of total seed yield)	0.6	2.4	6.6	10.6	13.3	14.7

[1] excluding 97 DAS

Table 4.4 Mean accumulative seed losses (kg/ha) between 94 and 129 DAS.

Reglone® application[1]		Accumulative seed loss (kg/ha)											
		DAS											
(DAS)	(L/ha)	94	97	100	103	106	109	112	115	118	122	125	129
97	0.0	0	9	19	43	70	128	168	193	211	231	268	293
97	1.4	0	10	30	84	110	154	179	189	200	211	233	292
97	2.6	0	7	25	66	93	142	183	200	223	247	277	309
97	5.3	0	7	21	84	106	143	167	178	188	199	222	247
103	0.0	0	7	17	41	61	101	147	168	194	212	250	286
103	1.4	0	16	31	51	87	156	200	218	230	247	273	299
103	2.6	0	8	16	43	74	153	198	216	234	252	282	315
103	5.3	0	5	9	31	57	121	155	172	184	200	231	277
109	0.0	0	9	20	46	66	112	162	184	206	221	245	271
109	1.4	0	4	11	31	53	84	169	188	198	209	232	259
109	2.6	0	6	15	46	72	124	217	256	273	290	324	341
109	5.3	0	5	16	42	63	114	195	218	233	252	312	338
Not applied	0.0	0	8	22	57	78	131	174	189	203	214	237	254
Not applied	1.4	0	9	19	53	82	148	200	200	250	282	308	339
Not applied	2.6	0	9	19	42	60	119	175	203	229	262	295	323
Not applied	5.3	0	11	25	50	49	112	150	171	195	209	253	275

1 mean of 4 replications

Table 4.5 Total accumulative seed losses (kg/ha) at 129 DAS

Rate of Reglone® application	Application date (DAS)				
	97	103	109	Not applied	Mean
No chemical	293	286	271	254	276
1.4 L/ha	292	299	258	339	297
2.6 L/ha	309	315	341	324	322
5.3 L/ha	247	277	339	275	285
Mean	285	294	302	298	295

Table 4.6 Mean accumulative seed losses (kg/ha) up to 10% moisture content for capsules.

Reglone® application[2]		Estimate DAS of 10% moisture content in capsules (Time of harvest)	Accumulative seed losses (kg/ha) before this DAS
Time (DAS)	Rate (L/ha)		
97	0.0	121	231
97	1.4	120	200
97	2.6	109	142
97	5.3	105	106
103	0.0	121	212
103	1.4	112	200
103	2.6	113	198
103	5.3	111	155
109	0.0	117	206
109	1.4	116	198
109	2.6	115	256
109	5.3	115	218
not applied	0.0	117	203
not applied	1.4	121	282
not applied	2.6	119	229
not applied	5.3	120	209
Mean for no desiccant		119	225

1 Mean of 4 replications

Table 4.7 Effect of desiccation on sesame seed quality.

Reglone® application						
Time (DAS)	Rate (L/ha)	1000 Seed wt (g)	Germination Normal (%)	Fresh ungerm (%)	Oil content (%)	FFA (%)
97	0.0	3.50	89	6	56.7	0.4
97	1.4	3.53	90	5	57.1	0.5
97	2.6	3.56	93	4	57.4	0.4
97	5.3	3.60	96	0	56.9	0.4
103	0.0	3.53	83	13	56.7	0.4
103	1.4	3.53	87	9	56.5	0.3
103	2.6	3.53	94	3	56.7	0.4
103	5.3	3.60	93	4	56.5	0.3
109	0.0	3.56	95	2	56.1	0.6
109	1.4	3.43	86	9	57.7	0.5
109	2.6	3.50	87	9	57.2	0.6
109	5.3	3.53	91	6	56.5	0.6
not applied	0.0	3.56	93	3	57.3	0.8
not applied	1.4	3.60	91	6	56.4	0.8
not applied	2.6	3.63	81	15	57.2	0.4
not applied	5.3	3.60	89	7	57.3	0.3
Mean		3.55	90	6	56.9	0.5

Table 4.8 Value of additional grain harvested as a result of desiccation

Reglone® application		Pre-harvest seed losses (kg/ha)	Advantage over no desiccant (kg/ha)	Value ($/ha)
Time (DAS)	Rate (L/ha)			
97	1.4	200	25	30
97	2.6	142	83	100
97	5.3	106	119	143
103	1.4	200	25	30
103	2.6	198	27	32
103	5.3	155	70	84
109	1.4	198	27	32
109	2.6	256	-	-
109	5.3	218	7	8
mean for no desiccant		225	-	-

Cost of application of 1.4 l/ha Reglone® = $38
Cost of application of 2.6 l/ha Reglone® = $70
Cost of application of 5.3 l/ha Reglone® = $143

Figure 4.1 Morphological (colour) characteristic of capsules allowed to dry-down naturally.

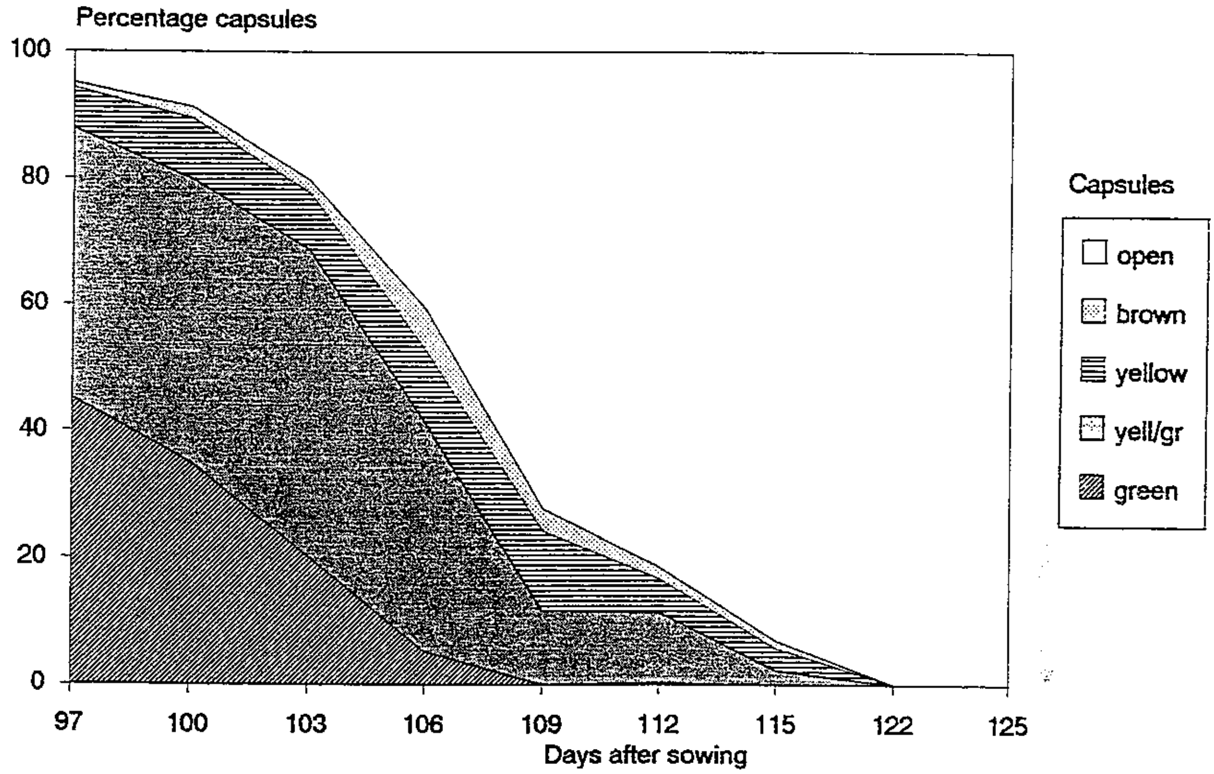


Figure 4.2 Capsule and stem moisture curves for plants allowed to dry-down naturally.

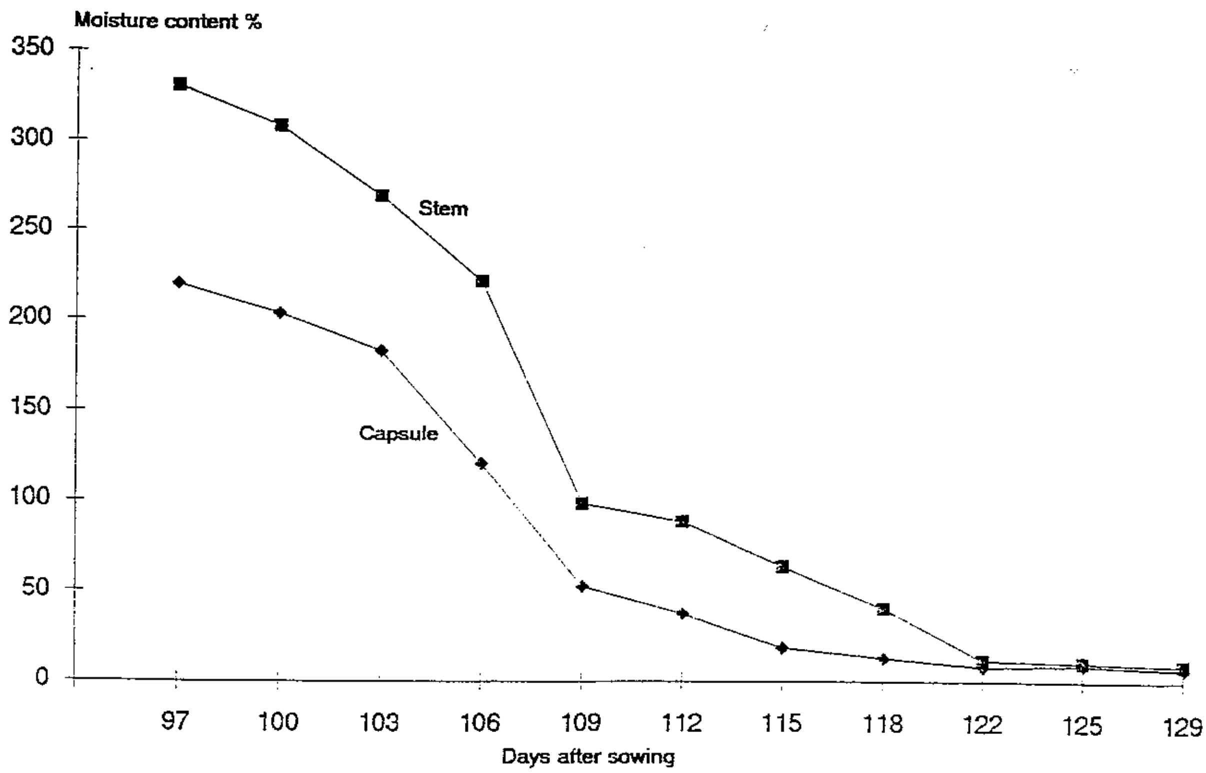


Figure 4.3a Morphological (colour) characteristic of capsules allowed to dry down naturally as the control for the 97 DAS desiccation treatments.

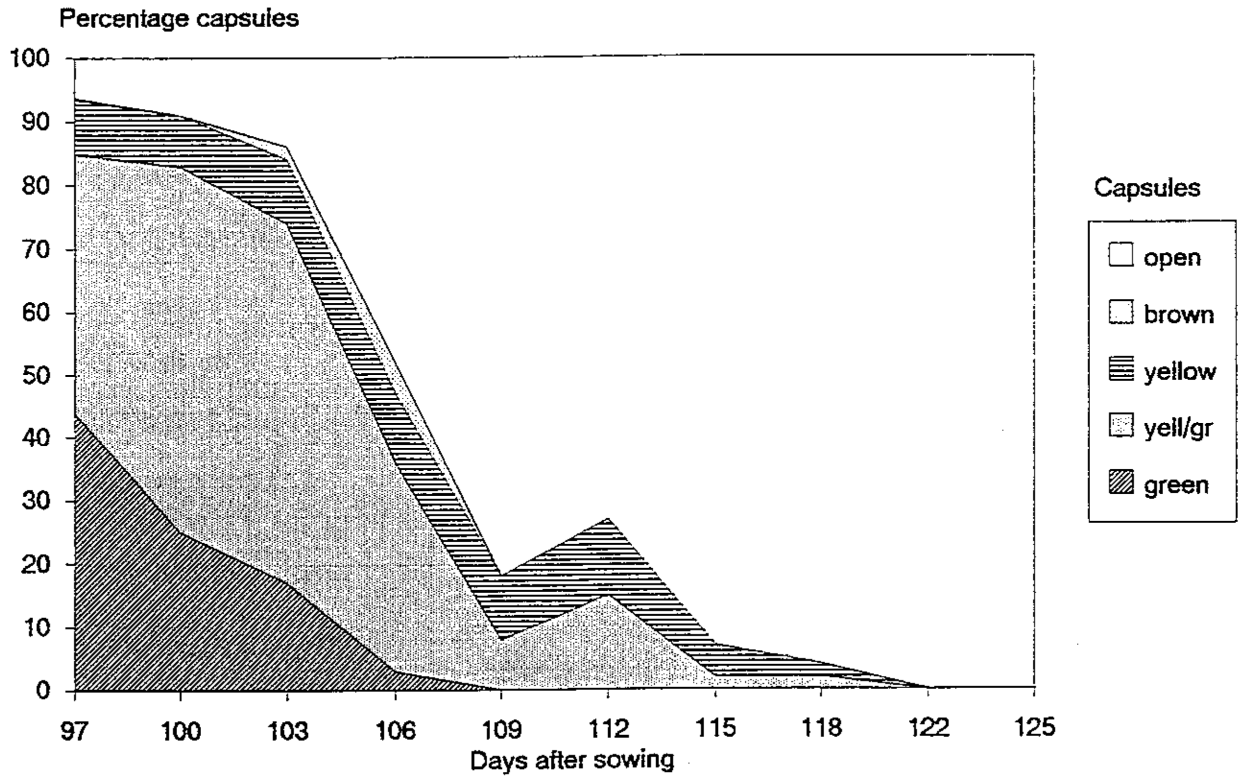


Figure 4.3b Morphological (colour) characteristic of capsules desiccated at 97 DAS @ 1.4 L Reglone®/ha.

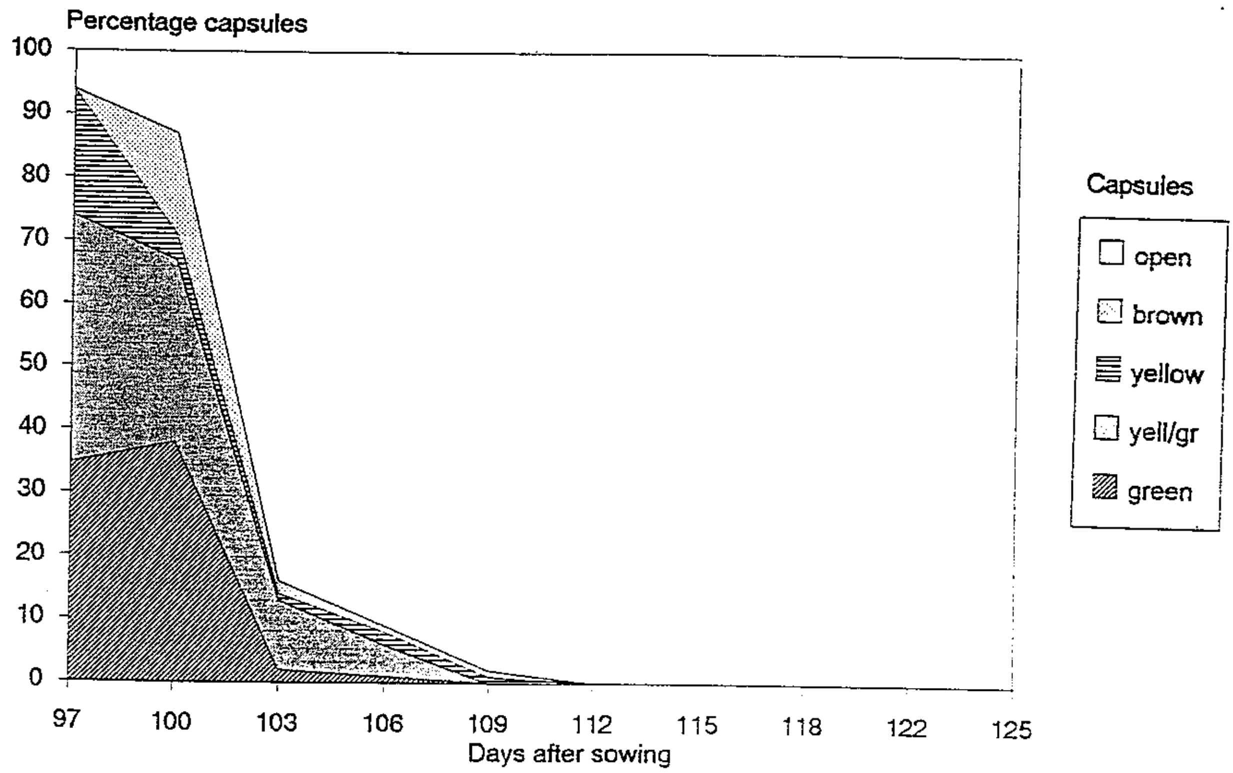


Figure 4.3c Morphological (colour) characteristic of capsules desiccated at 97 DAS @ 2.6 L Reglone®/ha.

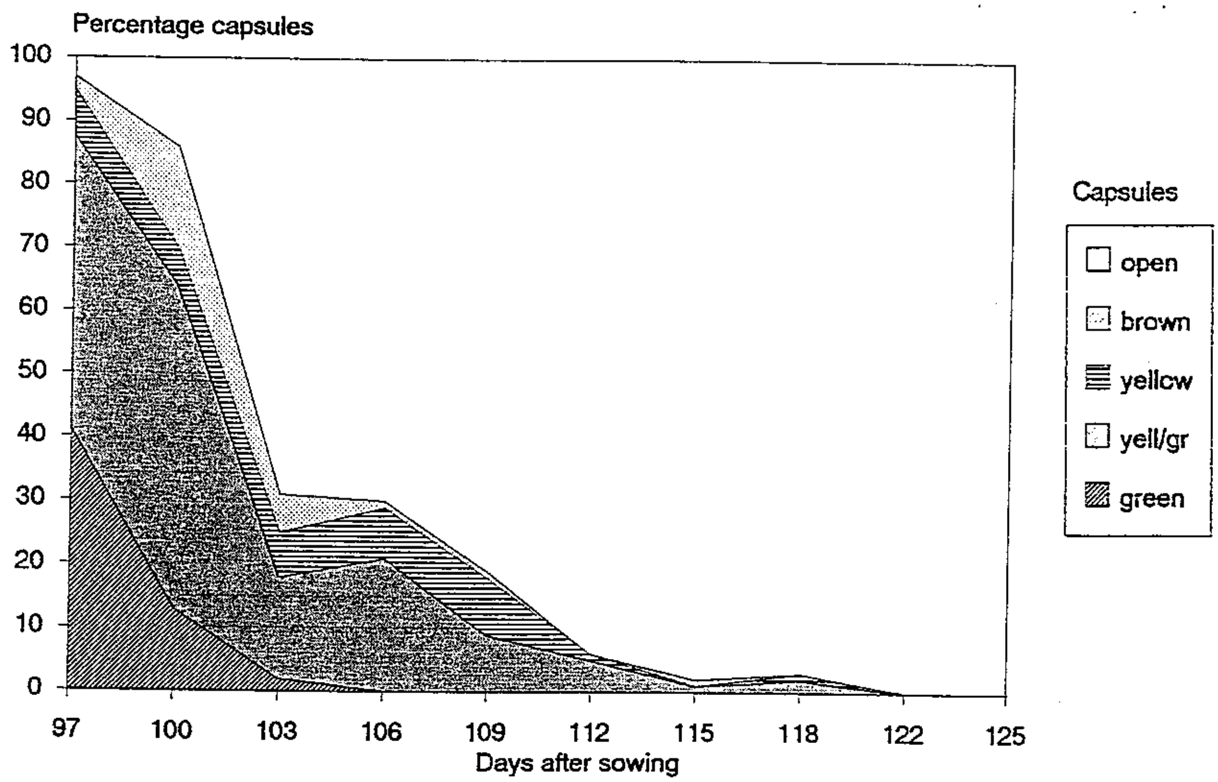


Figure 4.3d Morphological (colour) characteristic of capsules desiccated at 97 DAS @ 5.3 L Reglone®/ha.

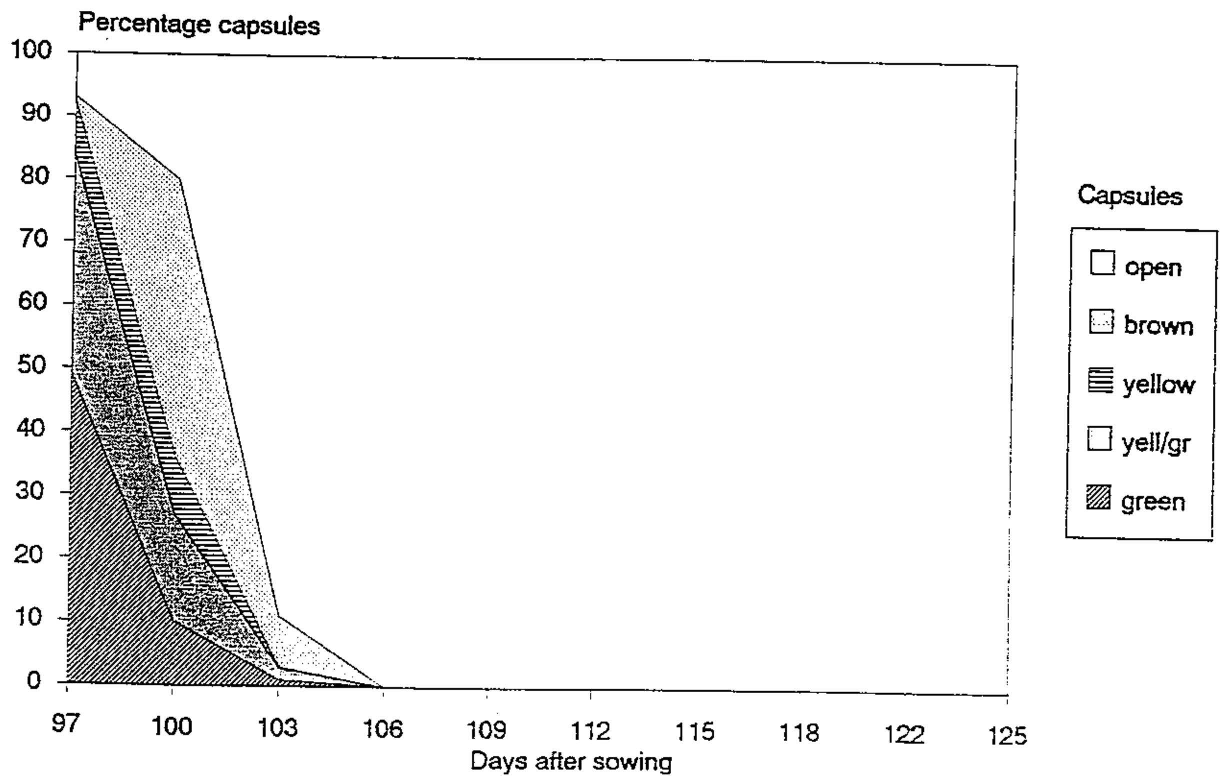


Figure 4.4a Capsule moisture curves for plants desiccated at 97 DAS.

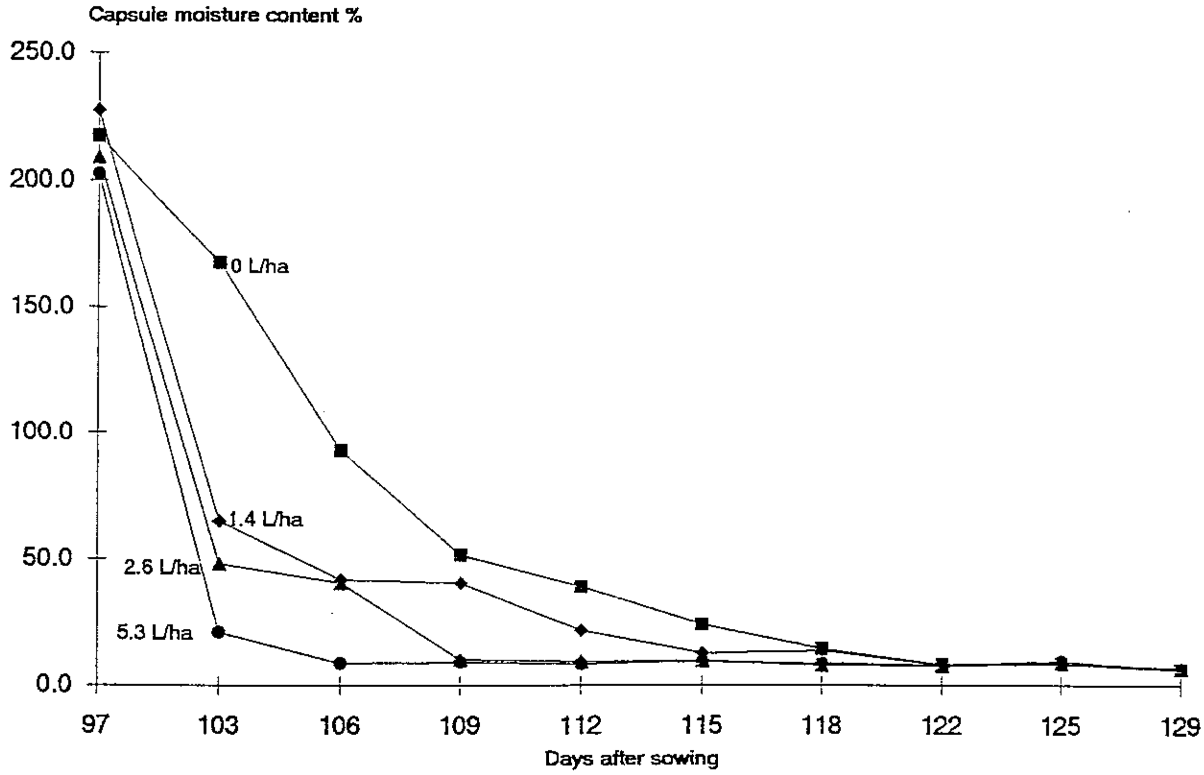


Figure 4.4b Stem moisture curves for plants desiccated at 97 DAS.

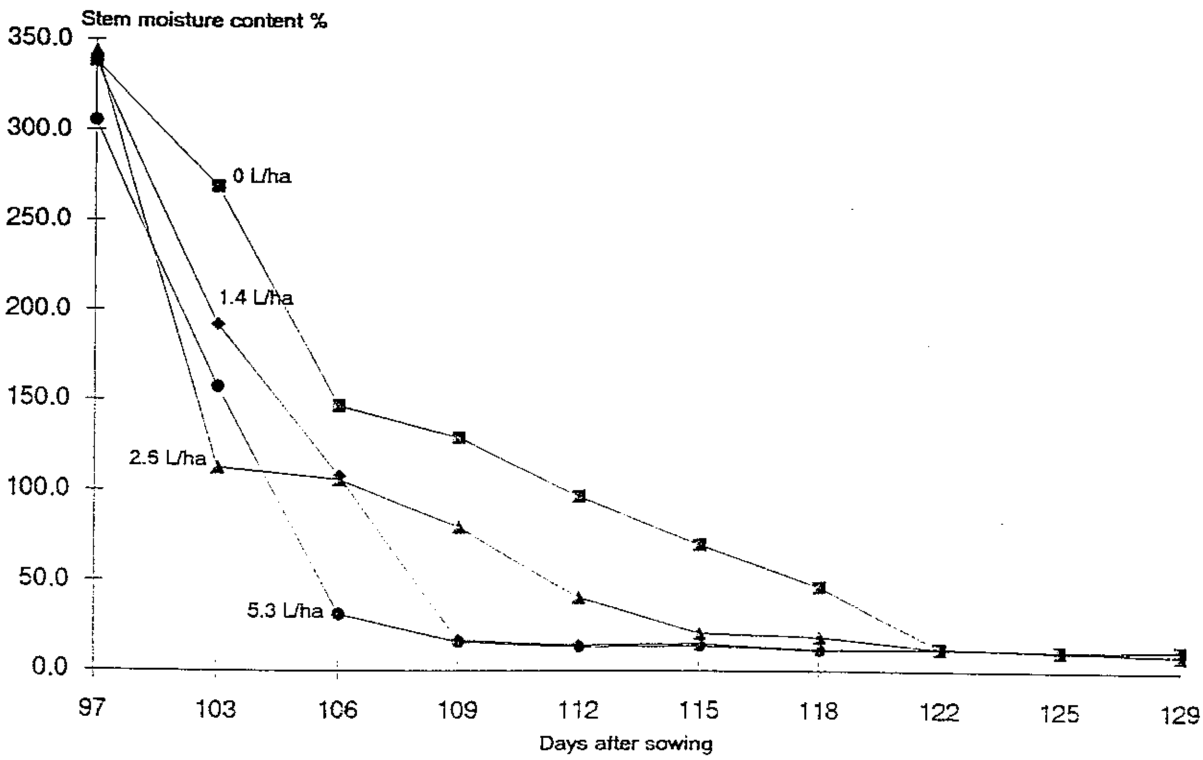


Figure 4.5a Morphological (colour) characteristic of capsules allowed to dry-down naturally as the control for the 103 DAS desiccation treatments.

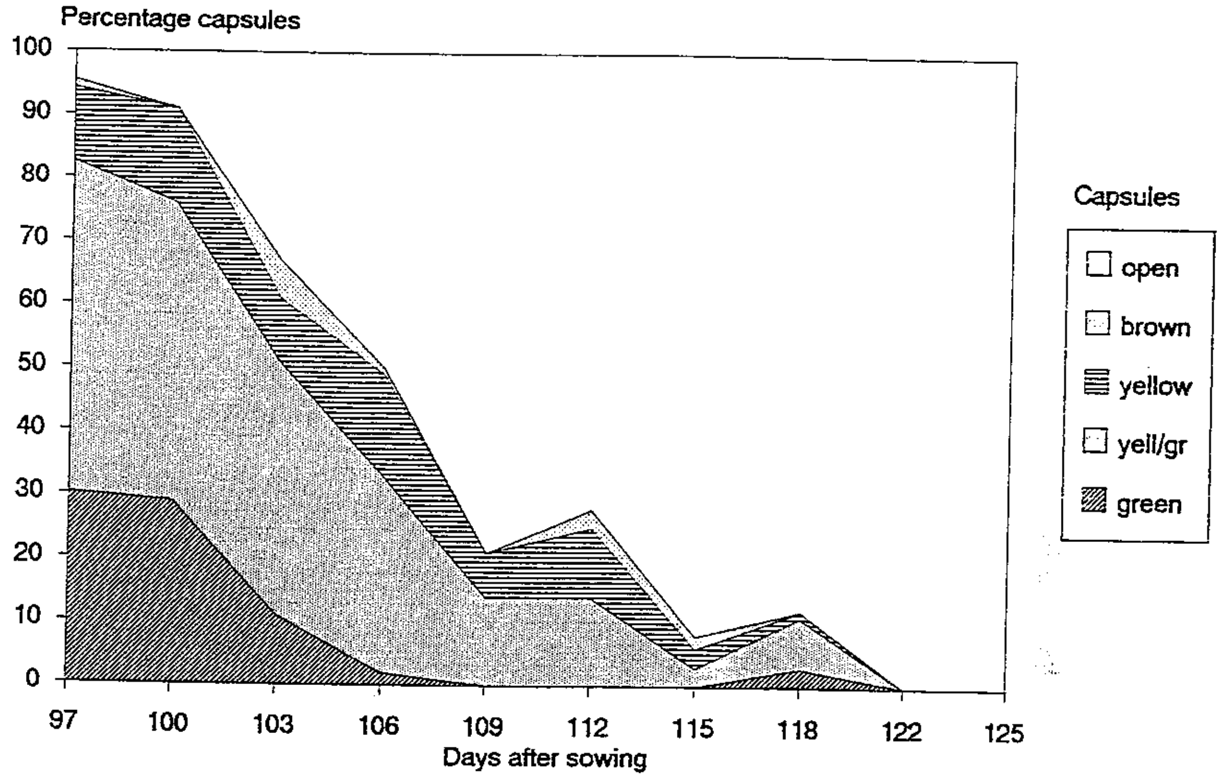


Figure 4.5b Morphological (colour) characteristic of capsules desiccated at 103 DAS @ 1.4 L Reglone®ha.

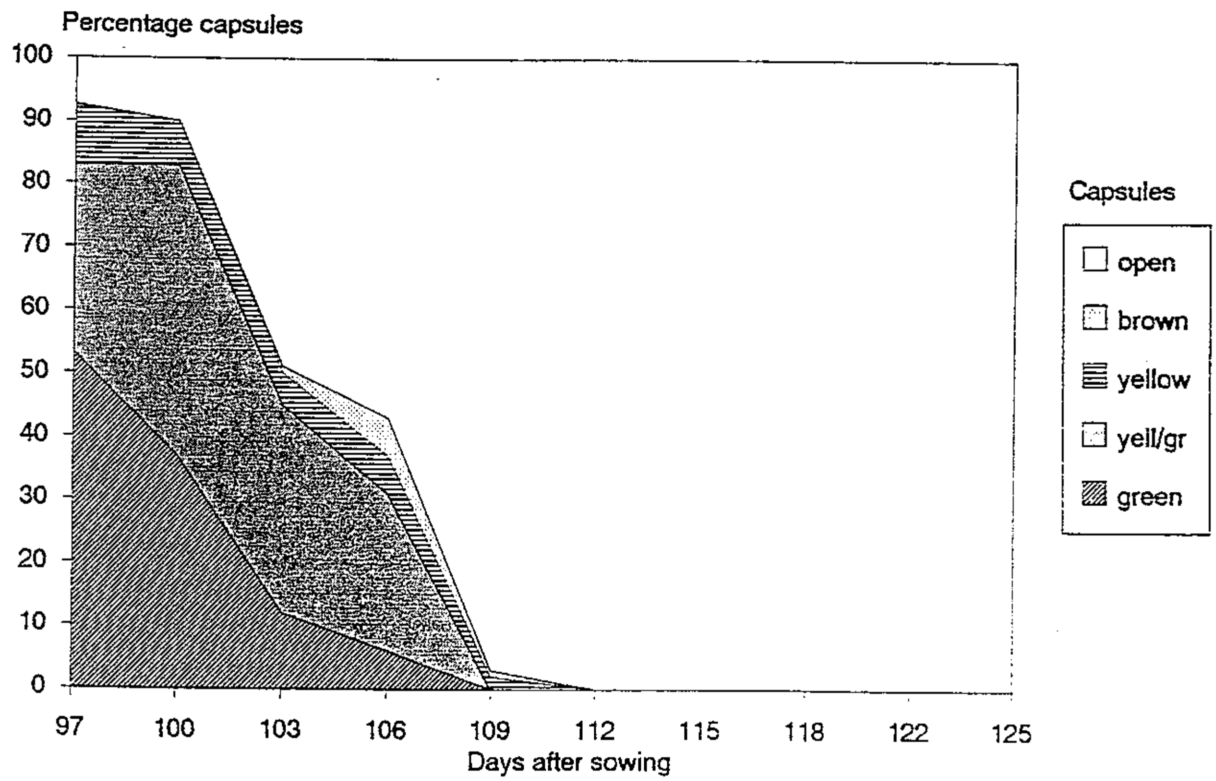


Figure 4.5c Morphological (colour) characteristic of capsules desiccated at 103 DAS @ 2.6 L Reglone®/ha.

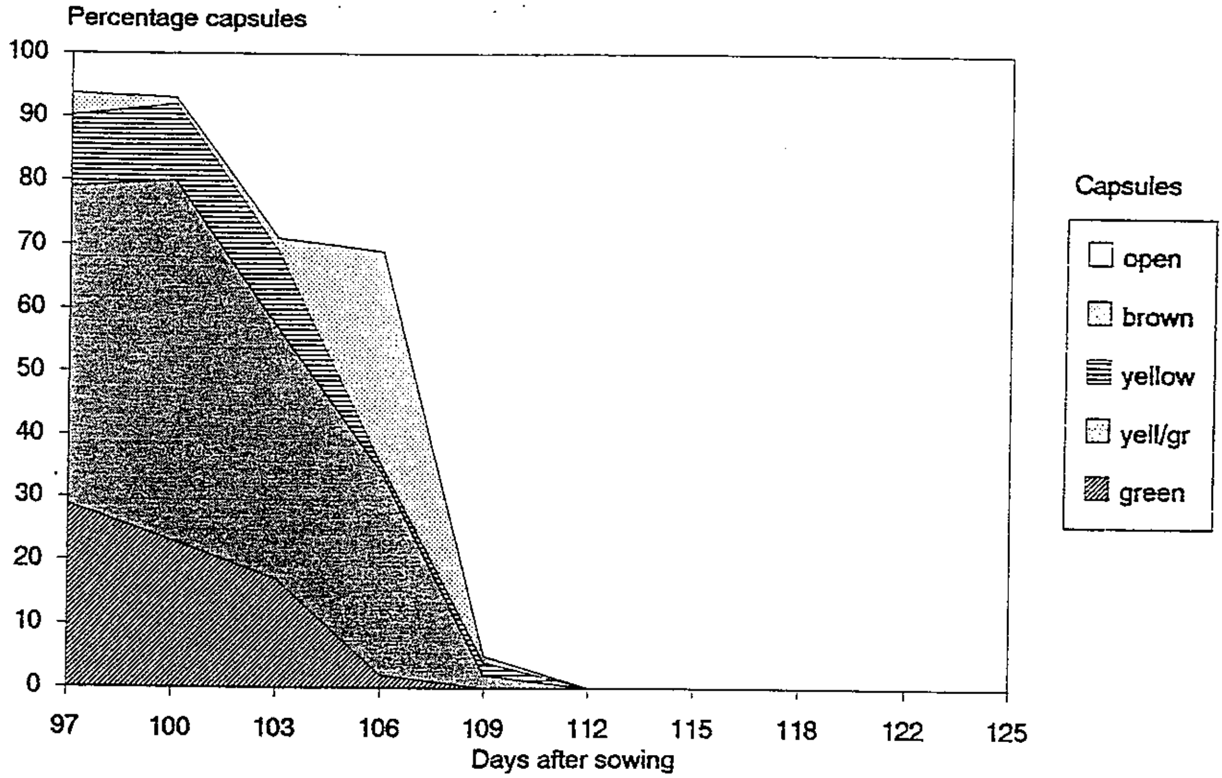


Figure 4.5d Morphological (colour) characteristic of capsules desiccated at 103 DAS @ 5.3 L Reglone®/ha.

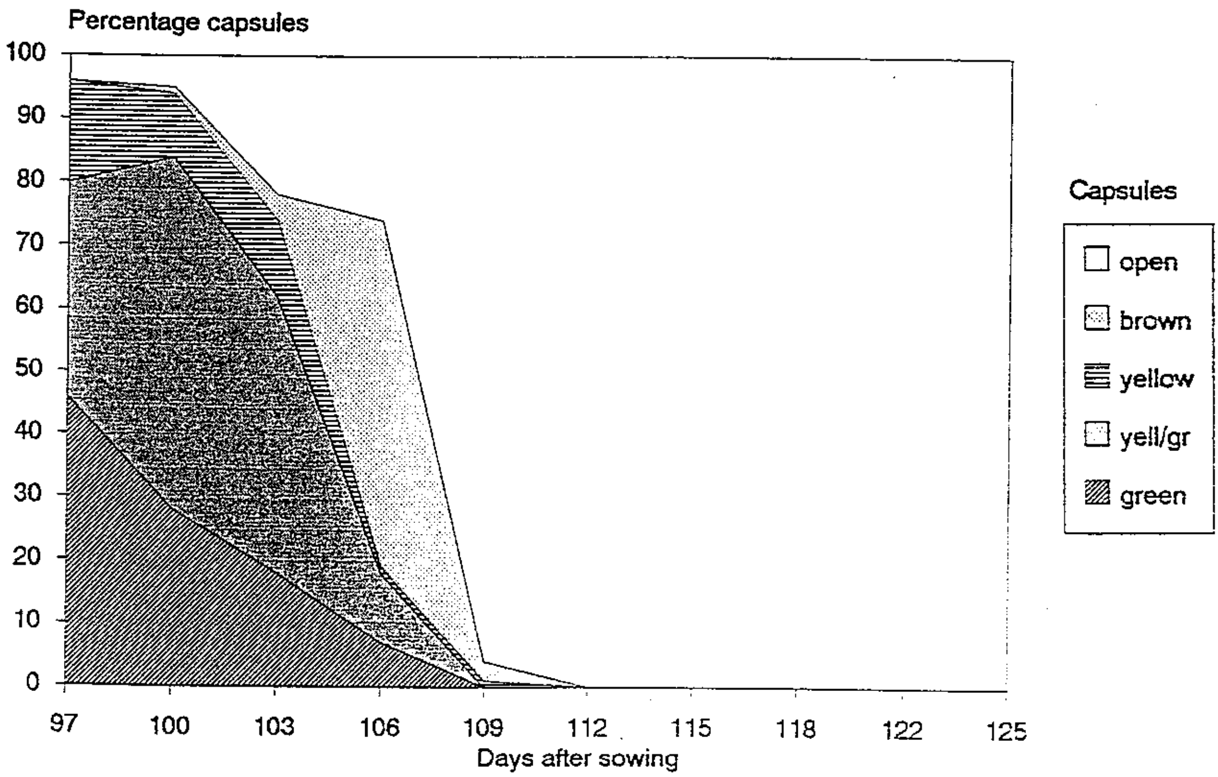


Figure 4.6a Capsule moisture curves for plants desiccated at 103 DAS.

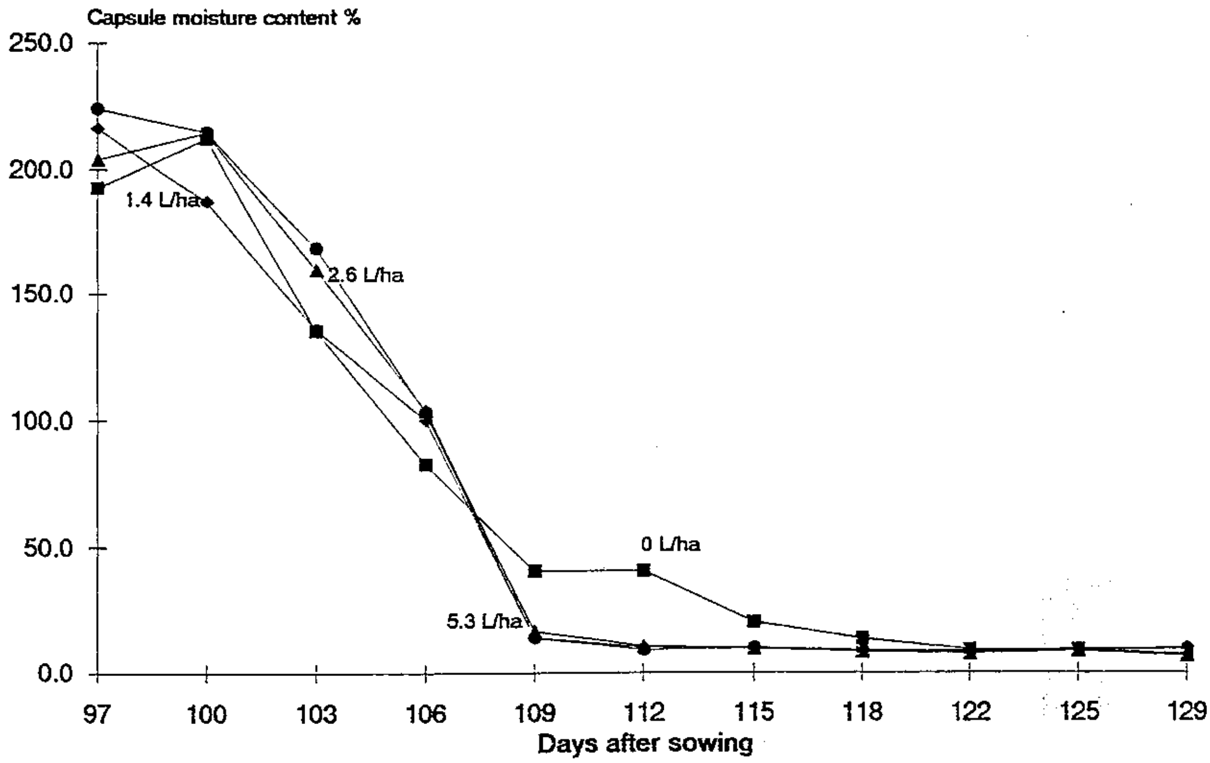


Figure 4.6b Stem moisture curves for plants desiccated at 103 DAS.

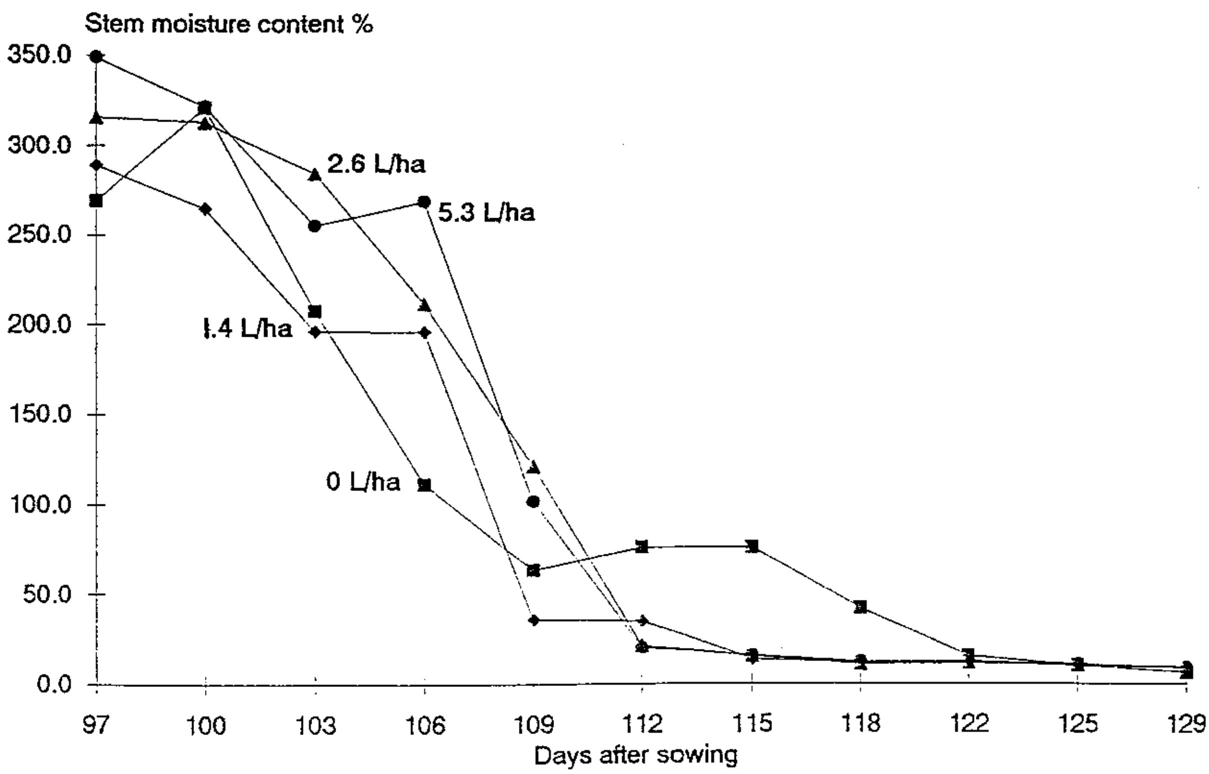


Figure 4.7a Morphological (colour) characteristic of capsules allowed to dry-down naturally as the control for the 109 DAS desiccation treatments.

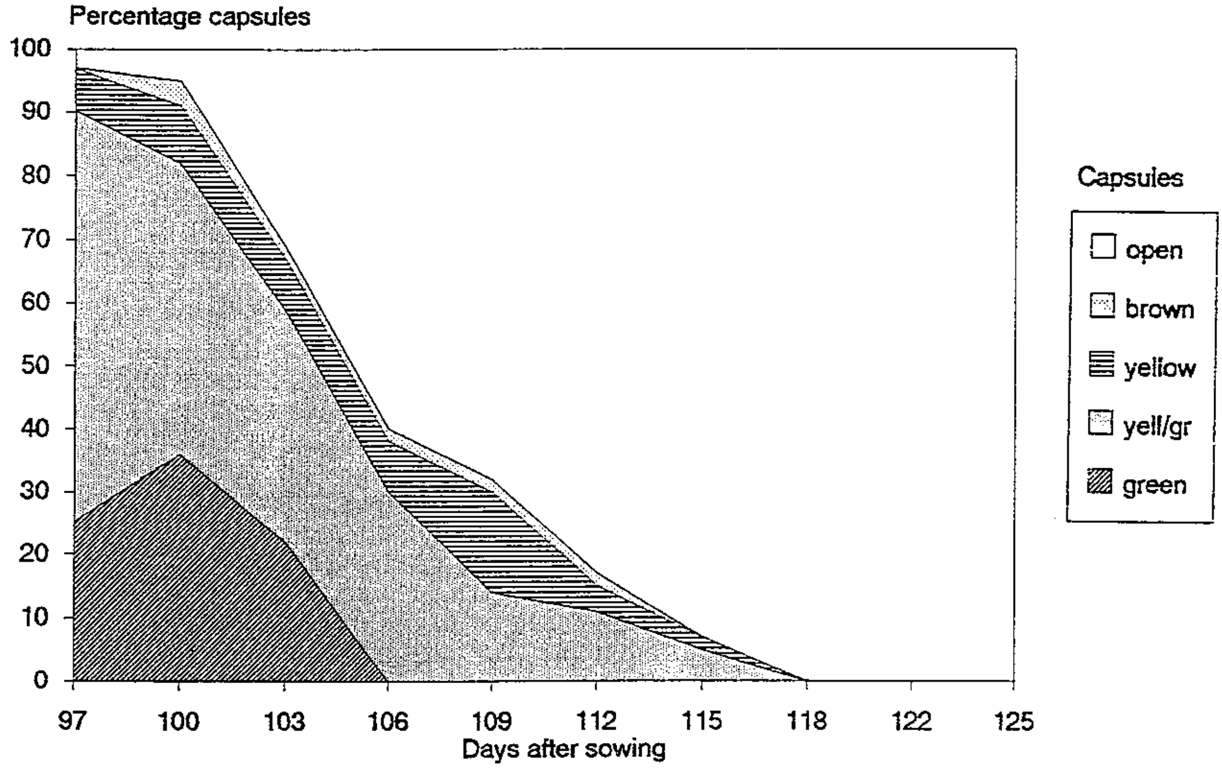


Figure 4.7b Morphological (colour) characteristic of capsules desiccated at 109 DAS @ 1.4 L Reglone®/ha.

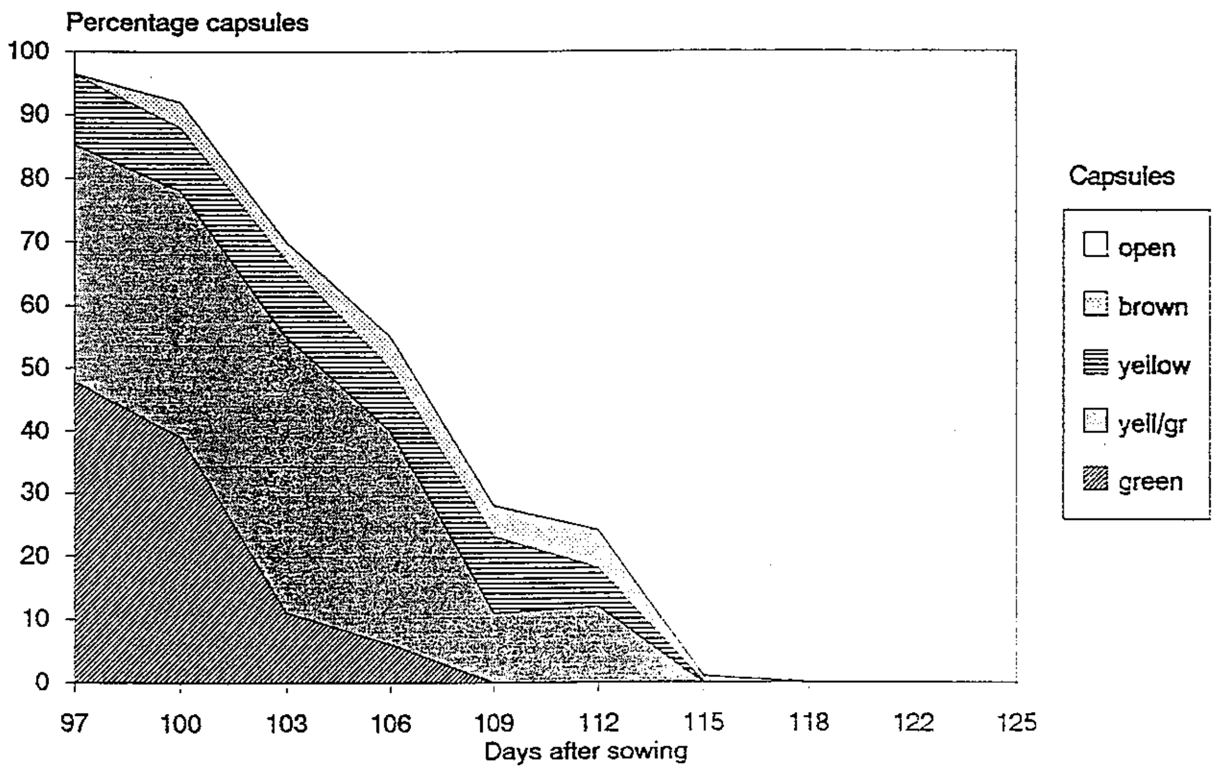


Figure 4.7c Morphological (colour) characteristic of capsules desiccated at 109 DAS @ 2.6 L Reglone®/ha.

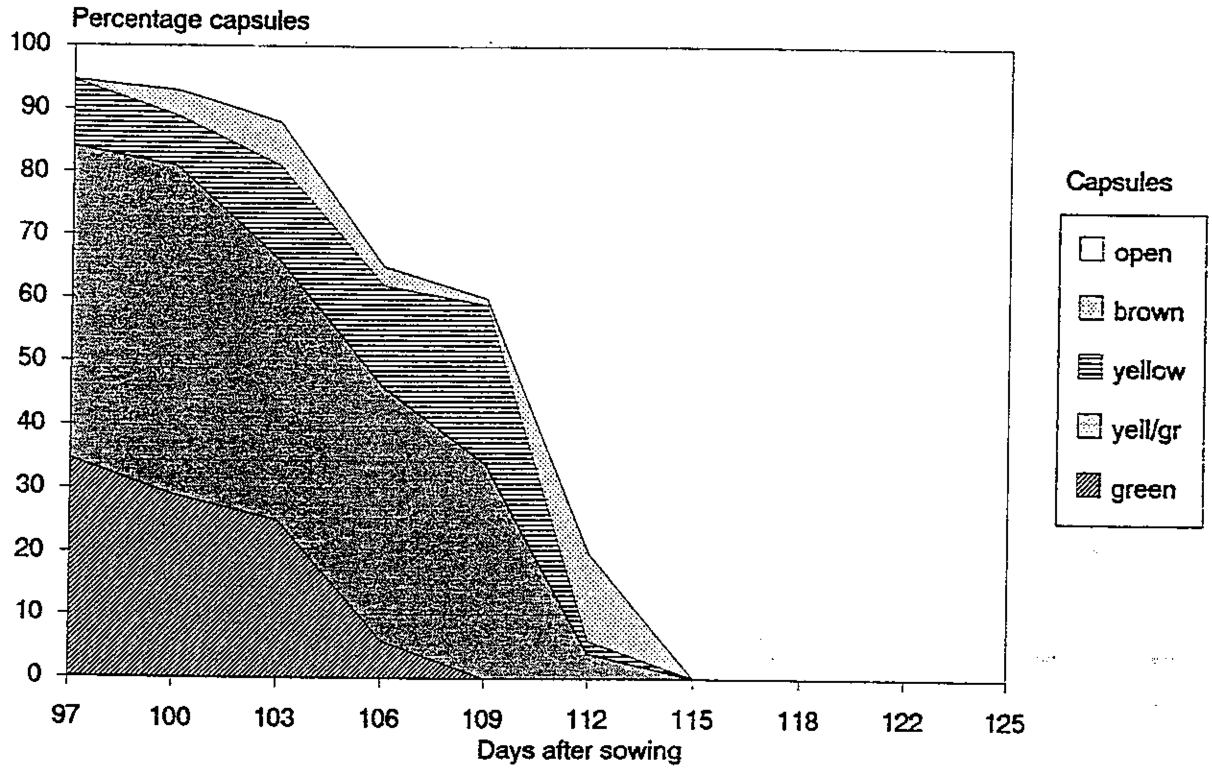


Figure 4.7d Morphological (colour) characteristic of capsules desiccated at 109 DAS @ 5.3 L Reglone®/ha.

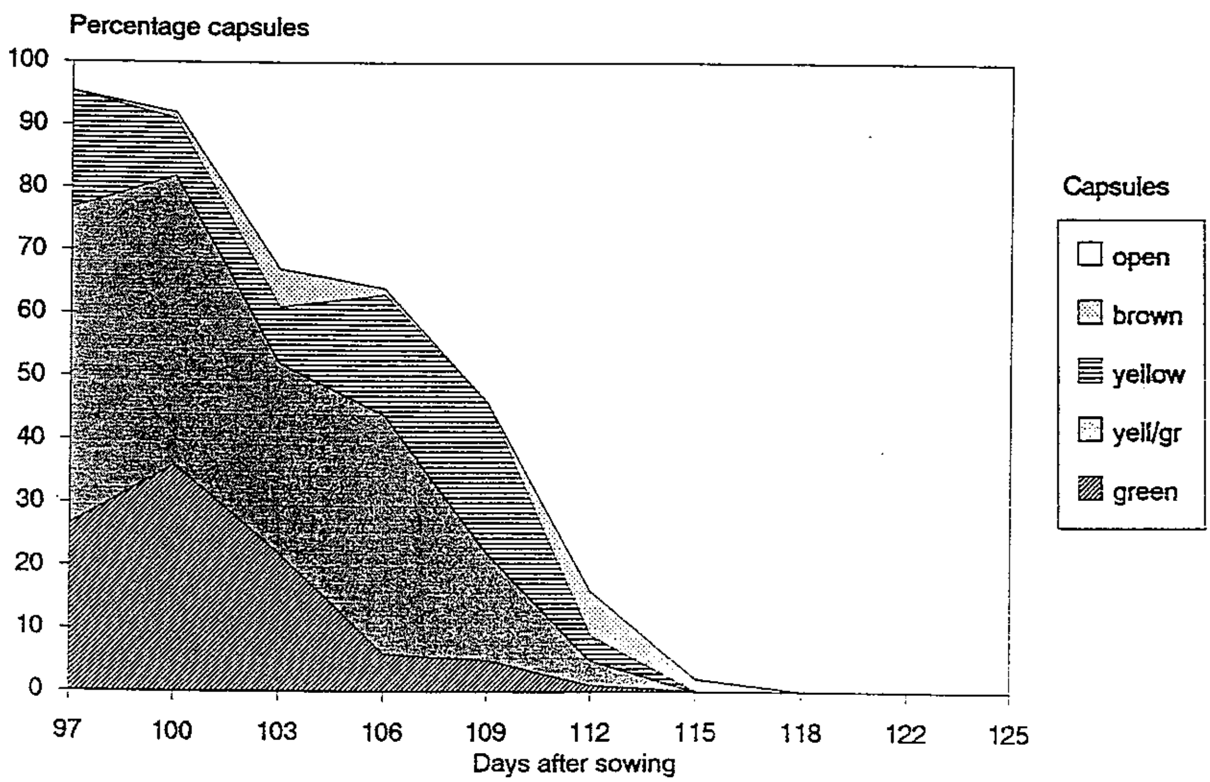


Figure 4.8a Capsule moisture curves for plants desiccated at 109 DAS.

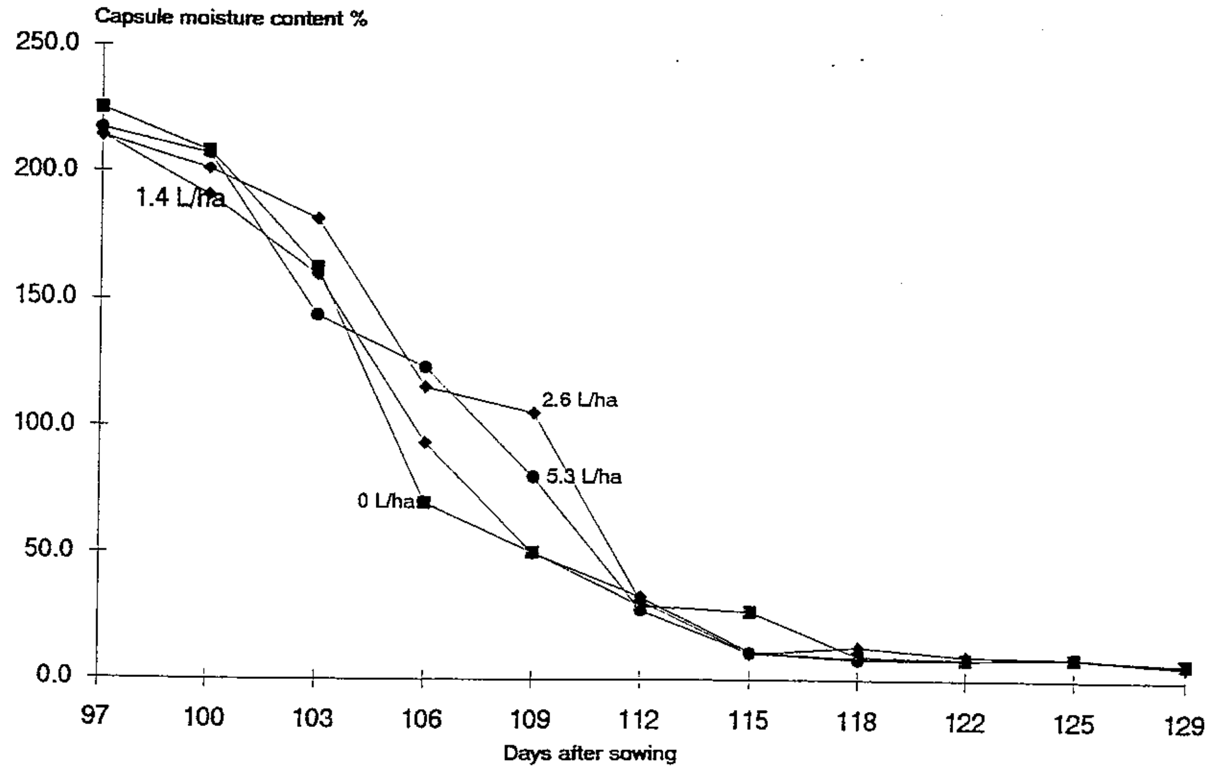
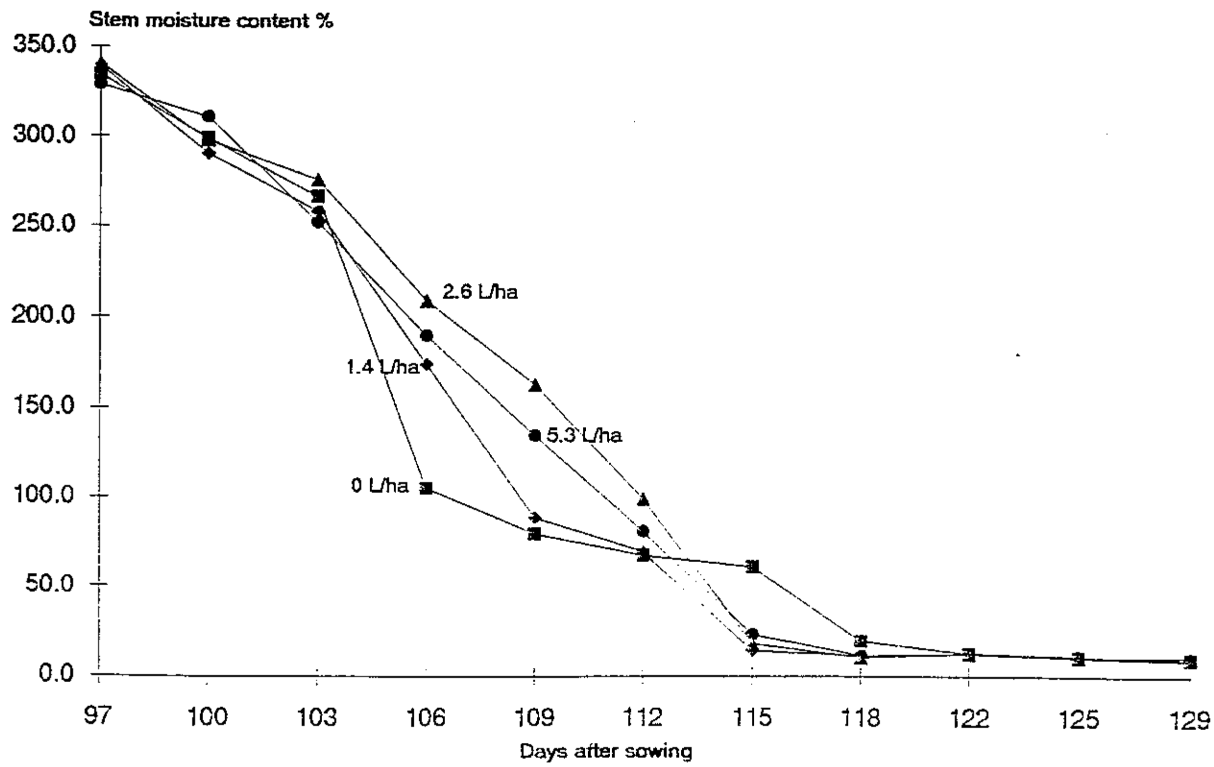


Figure 4.8b Stem moisture curves for plants desiccated at 109 DAS.



5. Effect of phosphorus and potassium on sesame seed yield and seed quality.

Introduction

Sesame is one of the new commercially cultivated crops in the Northern Territory having considerable potential as a major crop on the Red Earths (Alfisols).

Successful production of sorghum and maize on the Red Earth soils require high inputs of nitrogen, phosphorus and potassium. It is anticipated that similar inputs of fertilisers will be required to produce high sesame yields. The high costs of fertilisers in the Northern Territory emphasises the need to determine cost effective fertiliser recommendations.

The recommendations for phosphorus and potassium are based on those developed for sesame grown in Kununurra (WA) on Cockatoo sands and Cununurra clays.

This paper presents the effects of phosphorus and potassium of sesame seed yield and quality.

Materials and Methods

Design, treatments and management

Experimental design was a randomised complete block with a factorial combination of 4 levels of phosphorus and 3 levels of potassium. There were 4 replications. Levels of potassium (muriate of potash) were 0, 25 and 50 kg K/ha and phosphorus (triple superphosphate) were 0, 15, 30 and 60 kg P/ha.

A basal fertiliser of zinc sulphate, copper sulphate and urea at 5 kg Zn/ha, 5 kg Cu/ha and 31 kg N/ha as well as the experimental treatments was applied by hand and incorporated by raking on 13 January. The area had been top dressed previously (and incorporated) with urea at 29 kg N/ha.

Sesame genotype Y1:44 was sown on 14 January. Plot size was 7 rows x 3.0 m long with 32 cm row spacing. Establishment was variable, therefore all seedlings were destroyed with an application of Spray Seed® @ 2.0 l/ha. The experiment was resown with cv. Pachequino on 1 February.

Establishment was successful and sesame plants were thinned to an intra-row spacing of 10 cm (equivalent to 300 000 pl/ha) 15 DAS.

Recordings and data collection

Established plant populations for Y1:44 were measured 13 DAS, quadrat size was 0.5 m * 2 rows.

At 50 days after the 1 February sowing soil samples, 0-15 cm depth, were collected from each plot. Thirty youngest fully expanded leaves were collected from each plot 51 DAS for chemical analysis.

At physiological maturity (97 DAS), plant population, total plant biomass and seed yield were recorded by harvesting 2.0 m * 5 rows. Seeds from each replication was combined for 1000 seed weight and oil content determination.

Results

Establishment of Y1:44 at 13 DAS.

Plant establishment was affected by phosphorus fertiliser application (Table 5.1). The higher the level of phosphorus application the lower the established Y1:44 population. Potassium did not affect sesame establishment.

(Note: This experiment was resown with cv. Pachequino on 1 February because plant population effects would confound seed yield results).

Soil and leaf analysis at 50-51 DAS.

The application of high levels of phosphorus fertiliser (60 kg P/ha) did not affect levels of available soil phosphorus (Table 5.2). Regardless of phosphorus treatment, mean available soil phosphorus was 6 ppm. The application of high levels of potassium fertiliser resulted in an increase availability of soil potassium (Table 5.2). Leaf tissue analysis at 51 DAS indicate no significant differences in phosphorus and potassium concentration for the various levels of phosphorus and potassium fertiliser application (Table 5.3). Mean nitrogen, phosphorus and potassium concentration were 4.26%, 0.36% and 2.72% respectively.

Plant population and seed yield

Mean plant population for the 15 kg P/ha treatment was significantly less than for the remaining phosphorus treatments (Table 5.4). This difference was reflected in the significantly lower seed yields for the 15 kg P/ha treatment. The level of potassium application did not significantly affect seed yield (Table 5.4).

Mean plant population and seed yield were 269 000 plants/ha and 531 kg/ha respectively.

Harvest index

There was no response in harvest index to phosphorus or potassium fertiliser application (Table 5.4). Mean harvest index was 35.2%.

1000 seed weight and oil content

There was no response in 1000 seed weight and oil content to phosphorus or potassium fertiliser applications (Table 5.5). Mean 1000 seed weight and oil content were 2.64 g and 54.1% respectively.

Discussion

The re-establishment of this experiment with a February sowing and the cessation of the wet season on the 12 March resulted in minimal crop growth and seed set. Plant development in this experiment was principally limited by available moisture and not nutrition. This was indicated by the lack of significant difference in nutrient concentration between leaves for the nil treatment and all other fertiliser treatments.

However the following points are worth remembering when repeating this experiment. High levels of phosphorus fertiliser application may affect sesame establishment. To avoid this problem fertiliser treatment will be applied 7-10 days prior to sowing the experiment. It is expected that phosphorus will be readily fixed by the Blain soil.

This experiment needs to be repeated, hopefully with a successful January sowing, so that ptimum levels of phosphorus and potassium fertiliser can be determined.

Table 5.1 Establishment plant populations of sesame genotype Y1:44 at 13 DAS.

Treatment	Plant population ($x10^3$)
Phosphorus (kg/ha)	
0	281
15	247
30	198
60	145
Potassium (kg/ha)	
0	249
25	211
50	193
Overall mean	218

1 Plant distribution was variable

Table 5.2 Soil fertility at 50 DAS.

Treatment	pH	Conductivity (mS/cm)	P (ppm)	K (ppm)
Phosphorus kg/ha				
0	7.7	0.04	6	67
15	7.7	0.05	6	69
30	7.7	0.04	5	66
60	7.6	0.06	7	70
Potassium (kg/ha)				
0	7.7	0.05	6	58
25	7.7	0.05	6	69
50	7.7	0.04	6	78
initial fertility	8.0	0.05	5	60

Soil sample depth = 0-15 cm.

Table 5.3 Nitrogen, phosphorus and potassium content of youngest fully expanded leaf tissue at 51 DAS.

Treatment	N%	P%	K%
Phosphorus kg/ha			
0	4.31	0.35	2.68
15	4.30	0.39	2.74
30	4.13	0.34	2.70
60	4.30	0.35	2.73
Potassium (kg/ha)			
0	4.27	0.35	2.67
25	4.32	0.35	2.74
50	4.20	0.37	2.74
Overall mean	4.26	0.36	2.72

Table 5.4 Effect of phosphorus and potassium on plant population, seed yield and harvest index.

Treatment	Plant population ($x10^3$)	Seed yield (kg/ha)	Harvest index (%)
Phosphorus kg/ha			
0	279	519	35.8
15	248	459	34.4
30	278	559	35.6
60	271	587	35.2
LSD (5%)	16.7	81.8	1.23
Potassium (kg/ha)			
0	265	519	35.1
25	270	520	35.5
50	271	553	35.1
Overall mean	269	531	35.2
LSD (%)	14.4	NS	NS

Table 5.5 Effect of phosphorus and potassium on 1000 seed weight and oil content.

Treatment	1000 seed weight (g)	Oil content (%)
Phosphorus (kg/ha)		
0	2.67	53.9
15	2.64	53.8
30	2.64	54.1
60	2.64	54.4
Potassium (kg/ha)		
0	2.64	53.9
25	2.64	53.9
50	2.64	54.3
Overall mean	2.64	54.1

6. Monitoring demonstration areas of potential new sesame cultivars.

Introduction

During the last three years numerous sesame genotypes have been evaluated over a range of cropping areas in the Northern Territory. The genotypes were assessed on the following criteria: seed yield, seed quality, plant morphology and resistance to pests, diseases and lodging. Four genotypes were short-listed with Y1:44 being the most preferred, (Bennett and Martin, 1993). This year the four Northern Territory sesame genotypes, Y1:44, Y5:83, PB:64 and PA:45 and one Queensland sesame genotype, 339, were sown in approximately one and one half hectare demonstration areas to monitor their performance and assess market characteristics of the seed produced.

Materials and methods

Demonstration areas of the five potential sesame genotypes and reference areas of two current commercial cultivars were sown at various locations at Douglas Daly and Katherine.

Locations and agronomic practices are detailed in Tables 6.1, 6.2 and 6.3.

Sesame biomass and weed biomass were measured at 35-38 DAS at Garibaldi with 5 * 0.5 m^2 quadrats. Samples were partitioned into sesame, pigweed, calcavade, grass and other weeds (usually sida and hyptis) and then oven dried at 50^oC for 6 days. The plant material was analysised for nitrogen (N), phosphorus (P), potassium (K), and sulphur (S). At physiological maturity potential seed yield and plant population were determined with 5 * 1.0 m^2 quadrants.

Harvesting procedure is detailed in Table 6.7. Pre-harvest and harvesting seed losses were measured by G. Boyle, Agricultural Engineer.

All seed harvested was cleaned by the NT Grain Depot. Subsamples were collected for oil content and free fatty acid determinations. Further samples were sent to Huile Trading Co., Melbourne for market assessment, (roasting quality and suitability for tahini).

Results

Plant establishment

All demonstration areas were successfully established except for three locations. The first was Bush Paddock at Garibaldi, which was sown at too high a seeding rate resulting in a very high plant population. The second was Pachequino (southern end-line 1) which had to be resown on the 1 February because of poor crop emergence, while the plant stand for 339 was probably too low for a February sowing (Table 6.3).

Weed competition

Weed biomass levels at Garibaldi were very competitive during the first four weeks of crop establishment. This was due to the rapid height and canopy development of pigweed. Nutrient tie-up with this weed was approximately 2 kg N/ha, 0.4 kg P/ha and 5.0 kg K/ha (Table 6.6). The weeds were never smoothered completely by the sesame crops at Garibaldi.

All demonstration areas and reference sesame crops were successfully desiccated by aerial application of Reglone®. Potential seed yields and plant populations are detailed in Table 6.8.

Market assessment

The results of Huile Trading Co.'s assessment of the new genotypes for roasting and tahini qualities are presented in Table 6.9.

Discussion

Points of interest are as follows:

- John Lucas has adopted zero till technology for sesame production (two of the three NT commercial sesame farms now use zero tillage technology (data not presented).

- Nutrient tie-up with the weed biomass is probably not a major constraint in sesame crop development. However contamination from weed seeds or sap from the weed species coating the sesame seed at harvest is a major constraint. Seed produced from the bush paddock at Garibaldi was rejected because of tainting from sap.

- Under commercial conditions it is expected that the new genotypes will produce higher seed yields than Yori 77.

- The adoption of zero till has resulted in the farmers sowing sesame on wider row spacings to minimise problems with trash flow through the planter. However sowing on wider rowspacings causes a delay in canopy closure and the smothering of weeds.

- The adoption of the new sesame genotype (single stem type) compared to Yori 77 (branching type) makes successful crop establishment even more critical due to the poor compensating ability of the new sesame cultivar.

- Genotypes Y1:44 and PA:45 were the most market acceptable from the point of view of taste, however they produced the smallest seed after dehulling.

- Y5:83 produced the largest dehulled seed but scored lowest on taste.

- PB:64 scored between Y5:83 and Y1:44.

Table 6.1 Location, site preparation and area of sesame genotypes sown at Douglas Daly Research Farm and Katherine Research Station.

Location	Genotype	Site preparation	Area / paddock
Garibaldi[1]	Yori 77	zero tillage	40 ha / front paddock 10 ha / bush paddock
Garibaldi	Y5:83	zero tillage	1.5 ha / front paddock
DDRF[2]	339	conventional	0.7 ha / paddock 10
DDRF	Pachequino	zero tillage	0.7 ha / line 1, north end
DDRF	Y1:44	zero tillage	1.7 ha / line 1
DDRF	PA:45	zero tillage	1.9 ha / line 1
DDRF	PB:64	zero tillage	2.7 ha / line 1
DDRF	Pachequino	zero tillage	1.0 ha / line 1, south end
DDRF	Yori 77	conventional	10 ha / line 3
DDRF	Yori 77	conventional	8 ha / paddock 56
DDRF	Pachequino	conventional	2 ha / paddock 56
KRS[3]	Y1:44	zero tillage	0.03 ha / paddock 9

1 Garibaldi is owned by J Lucas
2 Douglas Daly Research Farm
3 Katherine Research Station

Table 6.2 Rates of basal fertiliser applied.

Site	Fertiliser	Application date
Garibaldi	100 kg / ha single superphosphate (11kg P/ha)	18 January
	130 kg / ha urea (60kg N/ha)	16 February
	50 kg / ha muriate of potash (25kg K/ha)	18 February
DDRF		
all sites	200 kg / ha single super phosphate (22kg P/ha)	17 January
Line 1	100 kg / ha muriate of potash (50kg K/ha)	17 January
Line 3	45 kg / ha urea (21kg N/ha)	18 January
Paddock 56	100 kg / ha urea (46kg N/ha)	14 February
Paddock 10	100 kg / ha muriate of potash (50kg K/ha)	17 January
	130 kg / ha urea (60kg N/ha)	1 February
KRS	130 kg / ha urea (60 kg N / ha)	7 January
	155 kg/ha 19:13 fertiliser (29 kg N/ha, 20 kg P) /ha)	6 January

Table 6.3 Sowing date, sowing rate and established population for sesame genotypes.

Genotype [1] (location)	Sowing date	Sowing Rate (kg/ha)	Established population (p/ha)
Yori 77 (front)	18 January	5	610 000
Yori 77 (bush)	23 January	?	1033 000
Y5:83	18 January	5	504 000
339	1 February	4	237 000
Pachequino (north)	18 January	4	232 000
Y1:44	18 January	4	544 000
PA:45	18 January	4	352 000
PB:64	19 January	4	268 000
Pachequino (south)[2]	1 February	8	344 000
Yori 77	19 January	4	236 000
Yori 77 (P56)	19 January	4	240 000
Pachequino (P56)	19 January	4	240 000
Y1:44 (KRS)	30 December	4	310 000

1 Germination percentage of all seed except Pachequino was 80 - 90%. Pachequino was 50% germination.

2 Resown on 1 February.

Table 6.4 Sesame and weed biomass at 35 - 37 DAS at Garibaldi.

		Plant biomass (kg/ha)					
Genotype	Sesame population	Sesame	Pigweed	Grass	Calcavade	Sida and Hyptis	Total Weed
Y5:83	504 000	87	60	4	-	3	67
Yori 77	610 000	109	59	12	-	2	73
Yori 77	1033 000	160	3	1	52	24	80

Table 6.5 Nutrient composition of sesame and weed biomass, 35 - 37 DAS at Garibaldi.

	Composition (%)			
Plant material	N	P	K	S
Sesame				
Y5:83	3.15	0.39	4.81	0.30
Yori 77 (a)	2.96	0.51	5.34	0.30
Yori 77 (b)	3.01	0.50	5.53	0.23
Pigweed (c)	2.67	0.38	8.16	0.23
Grass (c)	2.76	0.38	4.86	0.33
Calcavade (c)	3.48	0.32	3.02	0.24
Other (c)	3.04	0.43	3.66	0.40

(a) 610 000 plants/ha
(b) 1033 000 plants/ha
(c) mean for all samples

Table 6.6 Nutrient content of above ground biomass at 35 - 37 DAS.

Plant material	Nutrient content (kg/ha) N	P	K	S
Sesame				
Y5:83	2.7	0.3	4.2	0.3
Yori 77	3.2	0.6	5.8	0.3
Yori 77	4.8	0.8	8.8	0.4
Pigweed [1]	1.6	0.2	4.9	0.1
Grass [1]	0.1	<0.1	0.2	<0.1
Calcavade [2]	1.8	0.2	1.6	0.1
Other [1]	0.1	<0.1	0.1	<0.1

[1] Calculated for Y5:83 demonstration area.
[2] Calculated for Yori 77 (high population) demonstration area.

Table 6.7 Harvesting procedure.

Location	Procedure
Garibaldi	Aerial desiccation (2.0 L/ha Reglone) at PM[1] of Yori 77. Harvested by New Holland with an air front attachment (7 days after spraying).
DDRF	Aerial desiccation (2.0 L/ha Reglone) at PM of Yori 77. Harvested by an International with an airfront attachment (6 days after spraying).
KRS	Hand harvest and sundried.

PM[1] Physiological maturity (>98% capsules yellow).

Table 6.8 Hand harvested seed yields and plant populations measured at physiological maturity.

Location	Genotype	Plant population (p/ha)	Seed yield (kg/ha)
Garibaldi (front)	Yori 77	375 000	800
Garibaldi	Y5:83	428 000	1237
Garibaldi (bush)	Yori 77	788 000	170 [1]
DDRF	339	204 000	475
DDRF (north)	Pachequino	190 000	1349
DDRF	Y1:44	252 000	811[2]
DDRF	PA:45	268 000	999[2]
DDRF	PB:64	280 000	1003[2]
DDRF (south)	Pachequino	263 000	663
DDRF (line 3)	Yori 77	192 000	1705[3]
DDRF (P56)	Yori 77	283 000	1091
DDRF (P56)	Pachequino	207 000	1085
KRS	Y1:44	252 000	1877

1 Area affected by *Antigastra catalaunalis*.
2 Area affected by *Macrophomina phaseolina*.
3 Establishment very variable.

Table 6.9 Market assessment of the new sesame genotypes.

	Relative Ranking							
	Roasted Seed				Tahini			Mean
Genotype	Bitternes[1]	Odour[1]	Taste[1]	Seed size[2]	Bitternes[1]	Odour [1]	Taste [1]	Score [1]
Pachequino [3]	34	28	32.5	64.2	25	27	27	28.9
Yori 77 [4]	23.5	21.5	24.5	81.5	30.5	32	32.5	27.4
PA:45	31	27	31	65.0	29.5	30	28.5	29.5
PB:64	27	28	29.5	80.7	21.5	29	23	26.3
Y1:44	29	25	29.5	61.3	31	29	32	29.3
Y5:83	21	22	20.5	88.3	22	28.5	23.5	22.9

1 Maximum score of 50 points; 50 = highest quality seed.
2 Percentage of seed on screen > 1.7 mm.
3 Representative seed for the roasting standard.
4 Representative seed for the Tahini standard.

7. Effect of row spacing on sesame seed yield.

Introduction

The effect of row spacing and sesame plant population on seed yield has been investigated by various Australian authors over the last 10 years. Most authors have conducted the experiments under conventional tillage practices with a branching genotype.

The development of a new superior non-branching genotype for north-western Australia and the adoption of zero till technology has highlighted the need for a review of current agronomic recommendations.

Zero-tillage machinery used by farmers in the Northern Territory has been modified to sow crops at approx. 50 cm row spacing. The wider row spacing allows for ease of trash flow. The sow crops of a non-branching sesame genotype makes crop establishment more critical due to the new genotypes' lack of ability to compensate for intra-row gaps. While the wider row spacing also allows any weeds present to be more competitive due to the reduced canopy closure between rows. Weeds surviving the cropping season set large amounts of seed for following years.

This paper presents observations of the effect of row spacing on sesame seed yield for a non-branching genotype (Y1:44) grown under zero tillage conditions.

Materials and methods

Design, treatments and management

Experimental design was a randomised complete block with 3 row spacings - 35 cm, 70 cm and 105 cm and 4 replications. Plot size was 3.0 m * 8 rows (35 cm row spacing), 4 rows (70 cm row spacing) and 3 rows (105 cm row spacing).

Sesame genotype Y1:44 was sown with a cone seeder under zero till conditions on the 16 December 1993. Site preparation included mulching on the 9 December and spraying with Round-up CT @ 2.0 L/ha on the 15 December.

Plants were thinned to a population of 180 000 plants/ha at 19 DAS.

Recordings and data collection

At 74 DAS, 5 plants were sampled from the end of each plot and the following measured,

a) plant height
b) branch number
c) capsule number
d) leaf number
e) leaf area

At physiological maturity, plant population and potential seed yield were recorded by harvesting 2.5 m x 6 rows (35 cm row spacing), 2.5 m x 2 rows (70 cm row spacing) and 2.5 m x 1 row (105 cm row spacing) from each plot.

Results

Morphology at 74 DAS

Results are presented in Table 7.1.

There was no significant effect of row spacing on plant morphology at 74 DAS. Mean plant height, number of branches, capsules and leaves and leaf area was 138 cm, 0.8 branches/plant, 76 capsules/plant, 71 leaves/plant and 1886 cm^2 of leaf area.

Plant population and seed yield

Harvest plant population was significantly different for the 3 row spacings. The wider the row spacing the lower the final plant population (Table 7.2).

The highest seed yield (1224 kg/ha) was recorded for the narrowest row spacing (35 cm). This seed yield was significantly higher than that of the 2 wider row spacings (Table 7.2).

Discussion

This observation experiment plus the plant population experiment at Garibaldi will be used as preliminary background to a Row Spacing * Population Experiment next season. Observations from the row spacing experiment indicate that Y1:44 is unable to significantly compensate in plant morphology for differences in row spacing.

Plants growing in wider row spacing tended to produce a larger leaf area and support more capsules. However intra-row plant competition in these wider row spacings resulted in significantly fewer plants per hectare. Seed yield reflected plant population, higher plant populations produced higher larger seed yields.

This observation experiment suggests that sowing Y1:44 in wide row spacing (>70 cm) limits potential seed yield. There is a need to investigate the effect of row spacing between 35 cm and 70 cm.

Table 7.1 Effect of row spacing on plant morphology at 74 DAS.

Row spacing (cm)	Plant height (cm)	Branch number	Capsule number	Leaf number	Leaf area (cm^2)
35	135	0.6	66	67	1551
70	136	1.1	71	73	1822
105	142	0.6	91	73	2285
Mean	138	0.8	76	71	1886
LSD (5%)	NS	NS	NS	NS	NS

NS not significant

Table 7.2 Effect of row spacing on plant population and seed yield

Row spacing (cm)	Plant population (x 10^3/ha)	Seed yield (kg/ha)
35	185	1224
70	151	915
105	104	760
LSD (5%)	33.5	231.5

8. Effect of plant population on sesame seed yield

Introduction

The effect of row spacing and sesame plant population on seed yield has been investigated by various Australian authors over the last 10 years. Most authors have conducted the experiments under conventional tillage practices with a branching sesame genotype.

The development of a new superior non-branching genotype for north - western Australia and the adoption of zero till technology has highlighted the need for a review of current recommendations. The results of an observation experiment investigating the effects of row spacing on sesame seed yield have been discussed earlier in this report. This paper presents observations of the effect of plant population on sesame yield for a non-branching genotype (Y1:44) grown under zero till conditions.

Materials and methods

Design, treatments and management

Experiment design was a randomised complete block with 4 plant populations - 120 000, 200 000, 250 000 and 450 000 plants/ha and 4 replications. Plot size was 3.0 m * 6 rows at 54 cm row spacing.

This observation experiment was established by thinning the appropriate plots in the Y5:83 demonstration area at Garibaldi on 9 February (22 DAS).

Cultural details are presented in the earlier section "Monitoring demonstration areas of potential new sesame cultivars".

Recordings and data collection

At physiological maturity, plant population and seed yield were recorded by harvesting 2.5 m x 4 rows from each plot.

Results

Results are presented in Table 8.1.

Population and seed yield

Harvest plant populations and seed yields for the various treatments were significantly different. The highest seed yields were produced for plant populations between 200 000 and 250 000 p/ha. The lowest plant population of 118 000 p/ha produced the smallest seed yield. Seed yields were depressed at the highest plant populations.

Discussion

This observation experiment plus the row spacing experiment at KRS are being used as preliminary background to a Row Spacing * Population Experiment next season. Observations from the plant population experiment indicated that sesame genotype Y1:44 grown zero till in 54 cm row spacing produced their highest seed yields at populations of 200 000 to 250 000 p/ha.

Table 8.1 Plant population and seed yield

Established population (x 10^3 p/ha)	Harvest population (x 10^3 p/ha)	Seed yield (kg/ha)
120	118	330
200	196	1122
250	240	1012
450	426	688
LSD (5%)	27.1	293.5