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C. M. Francis

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1973 RESEARCH REPORT - C.M. FRANCIS

SUMMARY

Clover Scorch (Kabatiella caulivora) has continued as the most serious pasture problem in established pastures in high rainfall areas and considerable effort has again been devoted to screening for disease resistance. Genetic resistance in the variety Daliak has been confirmed and the resistance introduced into a range of later maturing parents. Several other varieties have demonstrated a valuable degree of field tolerance and the best of these will be seed increased in 1974 and 1975.

Competition experiments showed the ability of the newer clovers Seaton Park, Midland B and 39313Y to compete successfully, with Yarloop, whilst Seaton Park in particular appears capable of replacing that cultivar in non waterlogged areas.

In waterlogged areas, although no Kabatiella resistant variety has been found, several low formononetin crossbreds have demonstrated winter growth equal to Yarloop, with greater total production in the case of some crossbreds, notably Y47, whose maturity is ideally suited to Yarloop growing areas in W.A. and other States.

The early maturing low oestrogen crossbreds compared favourably in seed production with the Geraldton cultivar at Merredin. Crossbred 175.1 significantly outyielded Geraldton whilst the other four crossbreds and Northam A did not differ significantly in seed yield during the favourable 1973 growing season.

1. SUBTERRANEAN CLOVER IN THE HIGH RAINFALL AREAS.

(A) Clover Scorch Research.

This joint programme with Dr. Chatel has proven very successful, having made a number of significant contributions toward the isolation of Kabatiella resistant subterranean clover cultivars.

(1) Genetic Resistance of the Daliak Cultivar

The heritability of Daliak's resistance; previously inferred from studies conducted on F₃ lines of a Bacchus Bacchus Marsh x Daliak cross, has been confirmed by more detailed studies on F₂ populations of Midland B x Daliak and Shenton Park A x Daliak crosses. About 50 'resistant' plants from these crosses should provide enough seed for field testing in 1974. F₄ plants from the Bacchus Marsh x Daliak cross have also been grown for seed production and should also set adequate seed for field tests.

(2) Other Varieties of Low Susceptibility to Kabatiella

Toodyay C again showed a lower susceptibility to Kabatiella than Mt. Barker and set seed satisfactorily under a fairly extreme infection with Kabatiella at Denmark. It is about 5 days earlier flowering than Mt. Barker but its ultimate maturity appears about 1-2 weeks earlier and close to that of the Woogenellup cultivar. Three varieties were even less susceptible than Toodyay C, viz. 47308C, 47308D and Guildford D. 47308C and 47308D are low formononetin collections from Italy made by Dr. Gladstones. Guildford D was collected near Perth and has a moderate to high formononetin content. Guildford D closely resembles Daliak, is resistant to Kabatiella, and may be a natural Daliak cross. 47308C and D are about Mt. Barker maturity or slightly later but were mxxed lines in 1973 which will delay any seed increase programme.

(3) Selection for Kabatiella Resistance

Multiple regression analysis techniques were used to relate Kabatiella susceptibility to a range of plant parameters. Kabatiella damage was positively related to leaf size and petiole width, and negatively to maturity.

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Varieties with pale leaves (probably a reflection of more rapid growth rate) were also more susceptible.

Comparison of varieties selected for low susceptibility in 1972 with the unselected 1973 population showed a highly significant ($p < 0.01$) selection differential in favour of the selected material; evidence for the value of the current 'debris spread' techniques in selection for Kabatiella tolerance in the field.

(B) New Cultivar Evaluation

(1) Midland B

The fourth year data from an experiment at Mt. Barker Research Station has as yet provided no evidence that the Midland B variety is more competitive than Woogenellup when sown in mixtures under heavy set stocking. Furthermore, cropping did not significantly influence the proportion of Midland B despite its higher seed reserve and considerably higher hard seed content. This experiment has provided some interesting data relevant to cropping as a technique of pasture regeneration (Table 1). Cropping at Mt. Barker removed silver grass infestation without reducing total dry matter production of the pastures. This was largely due to a considerable increase in the size of clover plants after cropping. This may be partly due to the removal of grass competition whilst root rot fungi (or Kabatiella) may build up, assisting in weakening the clover plants in the older pastures.

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Table 1

EFFECT OF CROPPING ON CLOVER SIZE AND DENSITY - MT. BARKER.

Pasture	Cultivar	Density (clover plants per dm ²)	Size (mg/plant)	% grass
Fourth year	Woogenellup	37	17	32
Fourth year	Midland B	60	10	45
After Crop	Woogenellup	33	30	3
After Crop	Midland B	45	23	5

In a competition experiment with Yarloop and Seaton Park Midland B has to date not shown itself as good as the Seaton Park variety. Seaton Park in particular has invaded the Yarloop plots and appears capable of replacing Yarloop in non waterlogged areas provided grazing pressures are high (10 sheep/ha). The later maturing yanninicum 39313Y also improved its proportion in the mixtures despite a lower total seed yield; probably a reflection of a low hard seed content relative to Yarloop. (Table 2)

Table 2

Plant Establishment Counts. Competition plots Mt. Barker
(second year pasture)

Per cent of 1st mentioned variety

Seaton Park/Midland B	Yarloop/Mid.B.	Yarloop/S.Park	Yarloop/ 39313Y
1972 56	55	45	66
1973 67	35	19	45

(2) Sub Species Yanninicum

Low formononetin crossbreeds generally showed winter vigour equal to Yarloop, whilst later maturing varieties out yielded that cultivar in dry matter production at Denmark. (Table 3)

TABLE 3. PRODUCTION & MATURITY OF ssp. YANNINICUM CROSSBREDS (1973)

	Days 1st Flower	Senes- cence Rating* 21st Nov.	Winter Production 4 cuts to mid Sept. Denmark Mt.	+ Barker	Herbage Production 7 cuts to mid Nov. Mt. Denmark Barker	+ Seed Yield Denmark	
Yarloop	111	.6	1499	1879	2207	3596	565
Dinninup	126	2.3	1453	-	2824	-	844
Seaton Pk.	110	.6	1009	1658	1687	3197	565
Woogenellup	136	3.3	1729	3066	4065	5203	736
39313Y	145	3.6	861	-	3163	-	834
Y26	114	.8	2075	1643	3531	3423	645
Y47	126	3.0	1647	2847	4034	5022	725
Y68	116	1.8	2135	2475	3733	4414	558
Y72	109	0	1578	2330	2061	3860	373
Y85	109	0	1587	2575	2255	4368	502
Y111	121	2.3	1874	2512	3432	4368	743
Y155	115	1.1	1490	1751	1918	3694	564
LSD (p .05)			520	N.S.	942	1521	N.S.

* 0 = dried off 4 = no senescence + kgs/hectare

Y47 is the most promising of the low oestrogen yanninicum crossbreds, this years data confirming 1972 results. It is slightly earlier than Woogenellup, but is late enough to enable a late Oct. hay cut, and is potentially a much more valuable clover than Yarloop in virtually all areas subject to winter waterlogging of this and other states.

Y47 despite Kabatiella susceptibility can be recommended for release to farmers. A waterlogging tolerant variety of formononetin content 0.07 per cent (c.f. Yarloop 2.0 per cent); it is more productive than Yarloop and of maturity better suited to winter waterlogging areas, where Yarloop is frequently too early to take full advantage of the long growing seasons such areas usually offer.

2. DEVELOPMENT OF EARLY MATURING SUBTERRANEAN CLOVERS.

The development of the advanced generation (F7) early maturing crossbreds underwent three phases in 1973.

(A) Evaluation in rows

The continued testing for maturity and hard seed content from about 60 crossbreds at Wongan Hills and Merredin and Perth. Accurate flowering time data in the country centres was derived by pegging individual flowering plants every 2nd day. The work was carried out most efficiently by Department of Agriculture Research Station staff. Hard seed tests on the 1973 seed has commenced. Seed from rows at Geraldton are included in these tests and with this data and that already available from 1971 and 1972 final selections for field evaluation will be made. It is aimed to finish with 12-15 crosses in the 1974 field plot trials.

Although in the previous year (1972) flowering time of Geraldton and its crossbreds was relatively earlier in the inland centres than at Perth; this effect was not so apparent in 1973, a very much more favourable year from the plant growth viewpoint.

Crossbreeding has succeeded in producing a number of clovers with maturity earlier than the Geraldton cultivar, and 1973 data has supported previous evidence that transgression for flowering data has occurred with crossbred earlier than either parent. (Table 4.)

e.g. 29.1, 173.1, 175.1. c.f. Northam A: Cross 492.1 is the earliest of the Geraldton x Darglish crosses and with a rapid rate of maturation is also distinctly earlier than either parent.

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TABLE 4 MATURITY OF EARLY CROSSBREDS.

Cross Parents	Days to first Flower		
	Perth (Shenton Park)	Merredin	Wongan Hills
Northam A x Darglish			
*29.1	79	74	77
*46.2	82	77	78
*92B	80	77	77
*93B	80	75	78
*173.1	78	76	77
*175.1	78	74	77
*230.1.2	78	76	84
*231.2B	79	78	77
*337.1	82	75	77
Geraldton x Darglish			
396.2	87	86	84
457.1	84	81	83
480B	85	82	83
*492.1	82	81	81
*503.1	86	80	83
547.1	89	81	83
*584.1	86	81	82
598.1	84	81	82
Controls			
Northam A	81	78	78
Dwalganup	88	82	83
Darglish	84	79	81
Geraldton	97	88	86

* Included in Seed Increase Plots Medina.

(B) Seed Increase.

Seed increase of 12 crossbreds listed above together with control seed of Northam A and Geraldton, was carried out at Medina, largely organised by Dr. B.J. Quinlivan of the Weeds and Seeds Branch. Larger scale seed increase on a 'best bet' basis will proceed at Esperance in 1974 of 3-5 selected crosses one of which will be 175.1 (See below).

(C) Initial small plot evaluation of crossbreds.

For initial small plot evaluation, 2m x 1m plots (4 reps) were seeded at 75 kg/ha, and received two mowings during the winter months. The plots made excellent growth but the need for increased replication was obvious to achieve better precision.

In 1974 light grazing will replace mowing treatments. The results were however most encouraging, in a favourable season where the greater earliness of the crossbreds may have offered little premium. (Table 5).

TABLE 5

Low Oestrogen Early Sub Clover Crossbreds

Small plot yields kg/ha - Merredin Research Station.

<u>Variety or Crossbred</u>	<u>Seed Yield</u>	<u>Days to 1st Flowering</u>
175.1 (Northam x Darglish)	590.7	77
93B (Northam A x Darglish)	473.8	78
NORTHAM A	447.6	78
503.1B (Geraldton x Darglish)	443.0	83
DAGGLISH	436.5	81
GERALDTON	377.4	86
5841.B (Geraldton x Darglish)	331.7	82
337.1B (Northam x Darglish)	311.1	77
DWALGANUP	263.5	83

LSD. $p < .05 = 132$

$p < .01 = 190$

The seed yield of the crossbreds generally was very promising when considered in relation to Geraldton. 175.1 flowers at about the same time as Northam A but produces its flowers at a faster rate, so that in 1973 it was the earliest variety tested. Northam A, a low oestrogen variety being considered for seed increase, performed well in the trial and made impressive growth, though at slightly higher establishment densities than the other test lines.

3. SUBTERRANEAN CLOVER BREEDING.

F₃ rows of early maturing crosses were screened for maturity, growth habit, and formononetin content in 1973. These crosses are designed to widen the genetic base on which the early crosses are based, the current programme is evaluating derivatives of only two crosses viz. Northam A x Darglish and Darglish x Northam A. The additional crosses are Northam A x Geraldton, Mt. Helena A x Darglish, Dalkeith x Northam A, Northam C x Darglish, Bellvue x Northam A, Bellvue x Darglish, Dalkeith x Bellvue, Midland B x Darglish. In all 325 plants were selected for growing in F₄ rows in 1974. Rows will be planted at Perth and Wongan Hills.

A number of crosses (53) were made in 1973 in an attempt to incorporate Daliak resistance to Kabatiella into a range of varieties of late maturity. Perhaps the most interesting are Daliak x H.20 (a stunt virus resistant crossbred) and Daliak x Yarloop. The later cross is an interspecies cross and its success of vital importance to Kabatiella resistance breeding as no sources of resistance have been found in ssp. yannicum, clovers which grow most typically in wet areas ideally suited to Kabatiella.

PUBLICATIONS.

Chatel D.L., Francis C.M. and Devitt A.C. (1973) Varietal variation in resistance to clover scorch (Kabatiella caulivora) in Trifolium subterranean. W.A. Dept. of Agriculture Technical Bulletin 17.

Chatel D.L. and Francis C.M. (1974) Susceptibility of subterranean clover to clover scorch (Kabatiella caulivora) J. Aust. Inst. Agric. Sci. (In press)

Francis C.M. (1973) Influence of Isoflavone glycosides on the taste of subterranean clover leaves. J. Sci. Fd. Agric. 24:1235.

Francis C.M. and Poole M.L. (1973) Effect of waterlogging on the growth of annual Medicago species. Aust. J. Exp. Agric. animal husbandry 13:711.

Quinlivan B.J., Devitt A.C. and Francis C.M. Seeding rate, time of seeding and fertilisers for subterranean clover seed production. Aust. J. Exp. Agric. Animal Husbandry 13:681.

Accepted for publication.

Francis C.M. and Gladstones J.S. Relationships among rate and duration of flowering and seed yield components in subterranean clover. (Trifolium subterranean L.) (Aust. J. Agric. Res.)

Francis C.M. and Quinlivan B.J. Selection for formononetin content in red clover (Trifolium pratense), proceeding XII International Grasslands Congress, Moscow 1974.

Quinlivan B.J., Francis C.M. and Devitt A.C. Determinants of yield in subterranean clover seed crops. Proceeding XII International Grasslands Congress, Moscow 1974.

Francis C.M., Devitt A.C. and Steele P.R. The influence of flooding on the alcohol dehydrogenase activity of roots of Trifolium subterranean L. Aust. J. plant physiology.