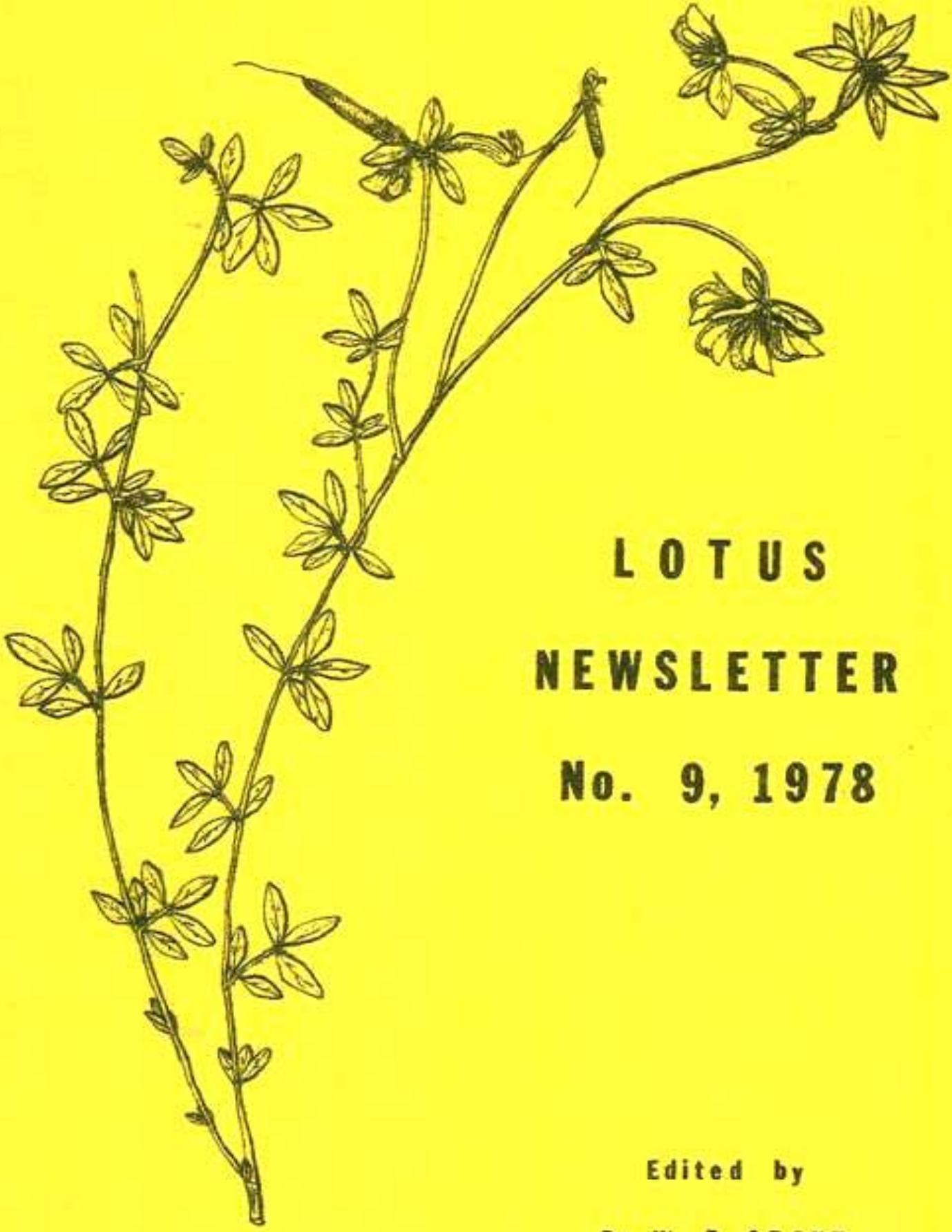

LOTUS NEWSLETTER

No. 9, 1978

Edited by

Dr. W. F. GRANT,

Genetics Laboratory,

Macdonald Campus of

McGill University.

Lotus Newsletter, No. 9, 1978

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Lotus Newsletter, No. 9, 1978

Introduction

The Lotus Newsletter consists of informal reports which are presented to further the exchange of ideas and information. These may be opinions or suggestions rather than established facts. Before quoting any statement in a publication the author involved should be requested to give his or her consent.

Cost of the Newsletter: The Newsletter is $2.00 per issue to cover the cost of production and mailing. The Newsletter will continue to be sent to those individuals from certain countries who are unable to contribute financially.

Contributions: Now is the time to send information for the next issue - recent published papers, news items, seed requests, techniques, research news, etc. For your convenience a form has been enclosed for miscellaneous items. Your Editor would be interested in receiving a short article for the opening paper which might be of general interest to Lotus Newsletter readers. Please write if you wish to contribute a lead article.

Lotus Newletter (1989). Volume 9, 3-4

J.P.A. ANGSEESING and M.A. SAUNDERS

St. Paul's College, Cheltenham, GL50 4 AZ, United Kingdom

No differentiation for cyanogenesis with respect to aspect in Lotus corniculatus

Two years ago we reported a pair of populations in which the south-facing population contained more cyanogenic plants than the north-facing one (Lotus Newsletter 7). This was an error since our north aspect sample took in a large proportion of plants of an acyanogenic species L. uliginosus.

Data accumulated over the last four years for a number of paired populations show only one significant difference between north and south aspects (Table 1) - and that in favour of the north aspect.

TABLE 1

Site	Year	Percent cyanogenic plants			
		North aspect		South aspect	
		%	Number	%	Number
Leckhampton Hill	1977	79	57	75	51
Notgrove 1	1975	61	131	43	80
Notgrove 2	1975	52	123	49	127
Notgrove 3	1975	58	85	29	41
Painswick Beacon 1	1976	82	50	75	52
Painswick Beacon 2	1976	84	50	67	57
Painswick Beacon 3	1977	80	51	80	54
Robins Wood Hill	1975	91	55	96	46
Crickley/Birdlip Hills	1978	54	113	58	116
Cleeve Hill (Postlip side)	1978	54	112	44	100
Silbury Hill	1960	18	28	14	91

The Silbury Hill figures are from the unpublished data of D.A. Jones. Notgrove 1, 2 and 3 are different sampling points within a railway cutting and Painswick 1, 2 and 3 separate ramparts of a pre-Roman fort. Several of the sites have been sampled on more than one occasion, usually with little change in cyanogenic plant frequencies. The Silbury Hill popu-

lations became extinct in the early 1970's and the Notgrove south aspect populations were killed off by the 1976 drought.

Field measurements have shown that there are lower temperatures and longer ground-frost cover at several of the north aspect sites as compared with the south-facing ones. One explanation of Table 1 is that temperature has little or no effect in causing differentiation between populations but it is also possible that a temperature effect is counterbalanced by the observed lower soil water content on the south aspects.

Lotus Newletter (1989). Volume 9, 5-6

B.O. BLAIR, C.L. SHYKERD, J.W. HERTEL AND V.L. LECHTENBERG

Agronomy Department, Purdue University, West Lafayette, Indiana 47907

Adaptation of Lotus corniculatus to Muck Soil

Most perennial forage legumes do not survive on muck soils in northern Indiana. However, birdsfoot trefoil, Lotus corniculatus L. has been found to survive for many years on the Pinney-Purdue Agricultural Center at Wanatah in northern Indiana. The predominate grass growing in association with birdsfoot trefoil is Kentucky bluegrass, Poa pratensis L.

An experiment with birdsfoot trefoil was initiated in August of 1977 on Edwards muck located on the Pinney-Purdue Agricultural Center. The two objectives of the study were: 1) to determine whether late summer seeding of birdsfoot trefoil was feasible and 2) to study the effect of a late fall applied straw mulch on winter survival of birdsfoot trefoil.

The vegetation on the experimental site was a thick sod of Kentucky bluegrass. On August 18, 1977 the sod was thoroughly rototilled, seeded to Empire birdsfoot trefoil at the rate of 5 pounds per acre and immediately irrigated to insure rapid germination. This was the only time the plots were irrigated as rainfall was adequate for rapid establishment. On October 20, 1977 a wheat straw mulch was applied at a thickness of about 2 inches to one-half of the experimental area. Twine was criss-crossed over the mulch to hold it in place. Stand counts taken just prior to applying the mulch indicated a stand density ranging from 6 to 13 plants/0.1m^2.

On April 6, 1978 the mulch was removed from the mulched plots. New leaves were just beginning to appear on the plants from the unmulched plots. Some new leaves were appearing on the old stems as far as 8 inches from the crowns.

Early spring growth was most rapid from the plants in the unmulched plots. The more rapid spring growth of the plants in the unmulched area was presumed to be due to a higher soil temperature. The spring was usually cold and wet. The unmulched soil being black absorbed more solar energy as opposed to the mulched plots as it was impossible to remove all of the straw mulch.

Later in the spring it was evident that the mulched plots contained more weeds, especially smartweed. The unmulched plots were relatively weed-free and growth of the birdsfoot trefoil plants was definitely superior in the unmulched plots.

All plots were clipped on June 21 but no weights were recorded due to the severe smartweed infestation in the mulched plots.

Data obtained from the plots on August 21, 1978 revealed the following.

	Crowns/0.1m^2	Seed pods/plant	Stems/plant
mulched	2.25	5.50	19.00
unmulched	5.25	13.75	93.25

It is apparent from these data that a fall applied straw mulch did not improve winter survival and based on this one year study actually had a detrimental effect. An adjoining experiment with red clover and ladino clover demonstrated that these two species were essentially 100 percent winter-killed where a mulch was not applied.

Lotus Newletter (1989). Volume 9, 7-8

DESMOND D. DOLAN AND WILLIAM R. SHERRING

Northeast Regional Plant Introduction Station, Rm. 201 Sturtevant Hall,

N.Y. State Agricultural Experiment Station, Geneva, N.Y. 14456

The Northeast Regional Plant Introduction Station has first responsibility for the maintenance of Lotus introductions in the National Plant Germplasm System. A 26-page cumulative catalog has now been prepared of all the Lotus introductions we have received and for which we have seed increases in the seed storage. This catalog was prepared as a computer printout and the print is large and legible. It lists all of the introductions that are available from the lowest P.I. number (P.I. 157531) to the highest P.I. number (P.I. 356000). The catalog is in tabular form, it gives the P.I. number, the country of origin, and plant descriptors as follows: uniformity from plant to plant, habit of growth, vigor of growth, plant size, number of stems, size of stems, leafiness or number of leaves, size of leaves, color of leaves, flower color, date of blooming, time of pod maturity, pod set, recovery after cutting in the late summer, winter hardiness or percentage of plants surviving the winter, and vigor of spring recovery. Notes were also taken on damage due to diseases and insects.

Copies of this cumulative catalog are available from the Coordinator, Regional Project NE-9, N.Y. State Agricultural Experiment Station, Geneva, N.Y. 14456.

Some Promising Introductions of Lotus corniculatus

During the interval mid-June to July 1977, notes were taken on various characteristics of trefoil introductions. Those introductions that were the most vigorous, leafy and persistent and should be further tested for use as forage are: P.I. 228233 Italy, 230332 Tur., 234804 Switz., 235101 Swe., 244036 Braz., 304280 Urug., 358997 Braz., and 383690 Tur.

A comment indicates that P.I. 234804 may be too short and have too low a plant habit for use as hay.

Comments on other promising introductions of Lotus corniculatus are as follows:

P.I. 325376 USSR - conspicuous for retention of good green color into the summer months and also for being a good seed producer.

P.I. 296318 Brazil - vigorous and leafy, not very wide spreading, surprisingly erect. One of the most erect in the planting. No lodging.

P.I. 303820 USA - vigorous and very leafy, not very erect, good dark green color. Showing some amount of leafhopper injury.

P.I. 303824 USA - vigorous and leafy, main feature is long stems, fairly leafy, not very erect, possibly semi-erect.

P.I. 325379 USSR - good retention of dark green color, stems long and almost prostrate, leaves small and slender, resembles Lotus tenuis.

G-18985 Urug. - some plants outstanding, some plants vigorous, leafy and erect. Also long stemmed. Not too good retention of green color, probably leafhopper damage.

G-18989 Urug. - variable but some plants very vigorous, leafy, tall and erect, very many stems. Surprisingly erect and long stems.

JUAN RAMON ACEBES GINOVES

Departamento de Botanica, Facultad de Ciencias, Universidad de La Laguna, Tenerife, Canary Islands, Spain

VICIEAE

Prof. Ginoves is involved in a study of the tribe Vicieae and the Canary Islands' taxa of Leguminosae.

He would like to be in touch with a number of specialists carrying out research on these plants. His intention is to study the endemics from multiple angles.

SHIRLEY DOBROFSKY AND W.F. GRANT

Genetics Laboratory, Macdonald Campus of McGill University,
Ste. Anne de Bellevue, Québec H9X 1C0, Canada

Incompatibility in *Lotus corniculatus*

The influence of self-pollination, cross-pollination, and absence of pollination on ovary protein subunit banding patterns using SDS-polyacrylamide gel electrophoresis was examined in clones of *Lotus corniculatus* L. cultivar 'Mirable'. Banding patterns from self-pollinated florets revealed the highest overall protein content and the largest amount of bands of the three treatments, whereas cross-pollinated florets revealed the lowest overall protein content and the smallest number of bands. Banding patterns differed between treatments within clones. All clones examined produced more seed per pod and longer pods after cross-pollination than after self-pollination, indicating that self-incompatibility did occur in these clones. Ovule position did not appear to affect the possibility of fertilization of an ovule. Further research is needed on the genetics of self-incompatibility in this species to permit establishment of clones with well-defined compliments of incompatibility alleles.

C.C. HEYN, UZI PLITMANN and LOUISE BAND

Department of Botany, The Hebrew University, Jerusalem, Israel

Cyanogenic Substances in *Lotus* Species

A survey is being carried out on the occurrence of cyanogenic substances in populations of 13 *Lotus* species growing in Israel.

Preliminary studies point to the existence of differences between species in the distribution of cyanogenic substances within populations and among populations.

DUANE ISELY

Department of Botany and Plant Pathology, Iowa State University,
Ames, Iowa 50011

Isely, D. 1978. New varieties and combinations in Lotus, Baptisia, Thermopsis and Sophora (Leguminosae). Brittonia 30: 466-472.

New Lotus Varieties and Combinations

Lotus argyraeus var. multicaulis (Ottley) Isely, comb. nov.

Lotus argyraeus var. notitius Isely, var. nov.

Lotus crassifolius var. otayensis Moran, var. nov.

Lotus dendroideus var. Traskiae (Eastw. ex Noddin) Isely, comb. nov.

Lotus dendroideus var. veatchii (Greene) Isely, comb. nov.

Lotus grandiflorus var. macranthus (Greene) Isely, comb. nov.

Lotus heermannii var. orbicularis (A. Gray) Isely, comb. nov.

Lotus nevadensis var. davidsonii (Greene) Isely, comb. nov.

Lotus oroboides var. nanus (A. Gray) Isely, comb. nov.

Lotus oroboides var. nummularius (M.E. Jones) Isely, comb. nov.

Lotus purshianus var. helleri (Britton) Isely, comb. nov.

Lotus stipularis var. ottleyi Isely, var. nov.

Lotus strigosus var. tomentellus (Greene) Isely, comb. nov.

JEANIE LARSON

Pacific Southwest Forest and Range Experiment Station, San Joaquin Experimental Range, 24075 Highway 41, Coarsegold, California 93614

Lotus Activities

Our range activities continue as outlined in last year's Lotus Newsletter, 8: 11, 1977. Studies with native Lotus species (L. crassifolius, L. oblongifolius, L. purshianus) are in progress.

LEOPOLDO MONTES

Instituto Nacional de Tecnologia Agropecuaria, Rivadavia 1439, 1039 Buenos Aires, Argentina

Professor Montes has started a study on Lotus tenuis (narrow leaf birdsfoot trefoil). This species has become naturalized in Argentina and grows spontaneously on low-land fields in Buenos Aires province. It is being developed as a forage legume. The studies are being carried out in conjunction with Dr. K.A. Okada.

A.D. O'BRIEN

Agriculture Research Station, Grafton, New South Wales 2460, Australia

I have selected a Lotus pedunculatus type from the Algarve area of Portugal distinct from the L. uliginosus of commerce. Seed has been increased and is sown in a grazing comparison on flood instigated acid sulphate soils of flood plain back-swamp areas: 2 hectare paddocks, a) commercial L. uliginosus, b) cv. Maku (L. uliginosus X L. pedunculatus,), c) Algarve selection, L. pedunculatus, d) early flowering selection from commercial L. uliginosus, e) composite L. hispidus, and f) nil legume control.

OTHMAR SCHWANK

Geobotanischen Institutes der Eidg. Techn. Hochschule, Zürich

Schwank, O. 1978. Biosystematisch-ökologische Differenzierung bei Lotus alpinus. 129 pages.
Summary from: Ber. Geobot. Inst. ETH, Stiftung Rübel, Zürich 45: 28-29.

Summary

The investigation deals with 106 populations of Lotus alpinus occurring on various substrates above timberline in surrounding of Davos (Grisons, Switzerland). In addition to field observations, studies on germination as well as some transplantation experiments were carried out.

Lotus alpinus within the alpine zone is differentiated into diploids (2n=12) and tetraploids (2n=24). A rather definite pattern of distribution of either race results from their respective ecological requirements. The diploid occur exclusively on silicate and most frequently are confined to altitudes higher than 2300-2400 m.a.s.l. The tetraploids inhabit silicate, dolomite and serpentine substrates; on silicate, however, only lower alpine stations are accessible to the 24 chromosomic plants and the contact zone between the two chromosomic races is remarkably narrow, whereas on dolomite and serpentine the tetraploids are found as well at higher altitudes. Phytosociological affinities of diploids and tetraploids within the contact zone are not distinct. As indicated by experiments, the absence of the diploids on substrates other than silicate is apparently due to competition. The distribution pattern observed on silicate seems to be influenced by the snowmelt time within the alpine zone.

A positive distinction between diploids and tetraploids was not possible, morphological variation being too pronounced, particularly in tetraploid plants. No hybirdization between the two races was found.

The 24 chromosomic plants originating from various substrates manifested some differences in habitus and behaviour and might accordingly be considered as local edaphic races.

A continuous transition between the tetraploid Lotus alpinus and Lotus corniculatus seems to occur; however, the problem of gene exchange between these taxa requires further study.

Cyanogenesis was studied in 490 plants of both chromosomic races of Lotus alpinus. Some trends that confirm the previous results of URBANSKA-WORYTKIEWICZ and WILDI (1975) are discussed.

In conclusion, comments on a further evolution of Lotus alpinus are given.

Lotus Newletter (1989). Volume 9, 15-16

G. SHEATH

Ministry of Agriculture and Fisheries, Whatawhata Hill Country Station, Waikato, New Zealand

I have just completed a three year study on the growth of defoliated Lotus pedunculatus cv. 'Grasslands Maku'. Morphological structuring, herbage production and nonstructural carbohydrate status of 'Grasslands Maku' were assessed for different defoliation regimes in two separate field experiments. The relative importance of several residual plant factors and assimilate partitioning in determining early shoot regrowth was studied in controlled environmental conditions. A brief summary of the work follows.

In the field experiments, seasonal differences in the partitioning of growth were recorded, with the spring to mid-summer period being dominated by aerial shoot growth and the late-summer, autumn period by underground growth. Of the underground components, rhizome growth was the most responsive to seasonal and defoliation changes and it was this horizontal stem system that formed the basis of basal shoot initiation.

Canopy growth became increasingly dominated by rhizome shoots as cutting height and frequency decreased and stubble shoots, stubble and dead matter declined. Following defoliation, regrowth was consistently slow during the first two to three weeks, thus production increases were achieved where regrowth intervals were extended and subsequent, higher growth rates were allowed to be expressed. Higher cutting improved

shoot regrowth, particularly in the stubble shoot pool, but increased within-canopy dry matter losses that were related to death and decomposition processes, resulted in little, if any improvement in net productivity.

Shoot regrowth responses resulting from higher cutting were primarily related to increases in the size of the residual shoot pools from which regrowth commenced. Residual shoot number and individual size were therefore important determinants of early regrowth. Any direct influence of residual nonstructural carbohydrate status on regrowth appeared to be principally confined to the rhizome shoot pool for the first few days of regrowth. The importance of accumulated starch would therefore appear to be related to the provision of metabolic substrate for underground respiration during late autumn to early spring.

Where defoliation was incomplete, residual stubble appeared to be an important source of current and redistributed assimilates during early regrowth. Following defoliation, redistribution of carbon compounds to shoot growth was principally confined to the rhizome shoot pool. Total shoot growth increasingly dominated the partitioning of current assimilates as plants recovered from defoliation. Where defoliation was incomplete it appeared that assimilate utilisation was a more important limitation to early shoot regrowth than assimilate supply.

Lotus Newletter (1989). Volume 9, 17-18

E.B. SWANSON AND DWIGHT T. TOMES

Crop Science Department, University of Guelph, Guelph, Ontario, Canada

Tissue Culture Studies in Birdsfoot Trefoil

The practical application of cell culture selection to plant improvement requires a suitable callus and suspension culture system, a correlation between whole plant response and *in vitro* response and a pertinent selection scheme for *in vitro* selection.

Selection for 2,4-D tolerance in birdsfoot trefoil has been one objective of cell culture studies of the plant cell culture laboratory at Guelph. T-68 is a tolerant *Lotus corniculatus* line in the field to the systemic herbicide 2,4-D (Devine, T.E. *et al*. Crop Science, 15: 721-724; 1975) and Leo is a susceptible cultivar in the field. Leo and T-68 were compared for seedling hypocotyl elongation and callus growth rates on different levels of 2,4-D. Shoot and root production on a variety of different auxin-cytokinin concentrations was also observed. A differential response to 2,4-D was established at every stage of development under study. Attempts to isolate tolerant clones in the susceptible cultivar Leo proved difficult, due to slow and variable callus production.

To facilitate *in vitro* selection mass selection for callus production from genotypes selected from the trefoil breeding program was initiated. Hypocotyls were dissected from meristem tip cultures of nine genotypes. Two cm sections were placed in vials containing 10 ml of B_5 nutrient media with 1 mg/l 2,4-D. On the basis of subsequent visual callus production and condition the genotypes were divided into slow or fast callus producing lines. Any genotype which could not be clearly characterized into fast or slow callus lines (i.e., had replicates in both fast and slow groups)

was discarded. The fast and slow callus producing genotypes were combined into fast and slow callus lines respectively. These two lines were grown with an unselected control and an experiment on their relative callus growth rates was performed, after the callus lines had been subcultured for approximately eight months.

The initial inocula consisted of 2 grams of callus evenly spaced throughout a flask containing 50 ml of B_5 stock with 1 mg/l 2,4-D and .8% agar. The average callus produced by the respective line in 21 days, alternating light-dark at 25°C is shown below:

Leo Fast	13.5 g
Leo Stock	9.2 g
Leo Slow	8.5 g

The fast line may be characterizeed as a light green, relatively homogeneous, very friable callus which differentiates readily. The fast line has also proven much more useful in suspension when compared to stock lines (unselected). The fast line not only produces 80% free cells on suspension but also has a consistently faster growth rate. Even after light homogenization with forceps, 5 grams of the fast callus produced 118,000 cells/ml in the upper aqueous phase, compared to the stock callus which produced 21,000 cells/ml . The fast line has proven faster at differentiating, though the total number of plants produced per gram of callus is apparently not increased.

Experiments to isolate in vitro 2,4-D tolerant lines are continuing with the faster growing callus line.

O. SZ.-BORSOS, E. HARASZTI and J. VETTER

Botanical Garden of Eötvös L. University and Veterinary College, Budapest, Hungary

Study of protein and microelement contents of Lotus corniculatus agg.

An investigation of the amount of protein and microelement contents of Lotus corniculatus was continued during the year 1977.

Twenty-one cultivars and wild growing taxa of Lotus corniculatus were compared to determine the amount of sodium, potassium, calcium, chlorine, phosphorous and protein. The analyses were performed on the second growth in June and August.

It was found that protein content was increased, generally, after the first hay-making in August with an average of 55.08 mg/g.

The most remarkable change was in the calcium content of the second growth. This was decreased between 20-26% mg/g.

There were no significant changes in the other microelement contents.

MARIO C. THERRIEN and W.F. GRANT

Genetics Laboratory, MacDonald Campus of McGill University,

Ste. Anne de Bellevue, Quebec, H9X 1C0 , Canada

EMS-Induced Mutants in Birdsfoot Trefoil Lotus corniculatus

Seeds of Lotus corniculatus, cv Mirabel, were treated with 0.1% ethylmethanesulfonate (v/v) for 6 hours at pH 5.6. M_1 plants obtained from treated seed were selfed and the M_2 obtained displayed two mutant segregants; one is of the virescent type, with yellow-green leaves near the apical regions demonstrating a gradual darkening to the basal leaves, the other demonstrates chlorosis in the cotyledonary stage of development. Preliminary results indicate that both mutant types appear to be tetrasomic recessives, and further experiments are being carried out to determine the precise mode of inheritance.

A third mutant tupe was obtained after treatment of dry seeds (cv. Mirabel) with 9 KR unfiltered X-rays at a rate of 230 rad/min. M_1 plants obtained from treated seed were selfed and the M_2 generation obtained in this manner produced a mutant in which the first foliar leaf was singular vs. the normal trifoliate condition. A segregating ratio of approx. 35:1 and a back-cross ratio of 5:1 have indicated that this mutation is a tetrasomic recessive. The symbol ul has been tentatively proposed for this mutation. An attempt at multiplying seed is underway. Research on mutagenesis in this species is being carried on for both qualitative and quantitative characteristics.

CHROMOSOME NUMBERS

*Lotus corniculatus L., cultivar Viglassky 2n=24. UKZUZ Praha. Determined by A. Uhrikova.

**Lotus corniculatus L., 2n=24. Czechoslovakia: Bitescka vichovina W. of Orechov. Dvorak 1977-41.

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*Majovsky, J. et al. 1978. Index of chromosome numbers of Slovakian flora (Part 6). Acta Fac. Rerum Nat. Univ. Comenianae, Bot. 26: 1-42.

**Dvorak, F. and Dadadova, B. 1978. In Chromosome number reports. Edited by A. Löve. Taxon, 27: 223.

PERSONALIA

JOHN D. MILLER has been reassigned from Blacksburg, Virginia, to Tifton, Georgia, at the Georgia Coastal Plain Experiment Station of the University of Georgia. He remains a Research Agronomist, USDA, Science and Education Administration. He will be working with a number of clovers plus probably some lupines, Dolichos, and Desmondium and other forage legumes. He will continue to coordinate regional variety tests for birdsfoot trefoil for the Southern Region.

Dr. W.F. LANGFORD, USDA, Southern Regional Plant Introduction Station, Experiment, Georgia 30212, distributes seed for those who may wish seed.

Pottinger, R.P. 1976. The importance of pasture pests in animal production. Proc. N.Z. Soc. Anim. Prod. 36:12-22.

Reid, C.S.W. 1976. Bloat in New Zealand cattle. Bovine Pract. 11: 24-27.

Riordan, J.R., Slavik, M. and Kartner, 1977. Nature of the lectin-induced activation of plasma membrane Mg^{2+} ATPase. J. Biol. Chem. 252-5449-5455.

Sarkar, S.K., Howarth, R.E., and Goplen, B.P. 1976. Condensed tannins in herbaceous legumes. Crop Sci. 16: 543-546.

Shaw, M.R. and Askew, R.R. 1976. Ichneumonoidea (Hymenoptera) parasitic upon leaf-mining insects of the orders Lepidoptera, Hymenoptera and Coleoptera. Ecol. Ent. 1: 127-133.

Smoliak, S. and Hanna, M.R. 1977. Seedling competition of some forage legumes in mono and mixed culture under greenhouse conditions. Can. J. Plant Sci. 57: 897-903.

Swanson, E.B. and Tomes, D.T. 1978. Breeding for 2,4-D tolerance in Lotus corniculatus cell cultures. Agron. Abstr., Am. Soc. Agron. 70th Annu. Meet. Chicago, Ill. p. 63.

Tanasijevic, N. 1975. Another contribution to the knowledge of Apions (Apion:curculionidae) of our country. Zast. Bilja, 26: 345-352.

Uttal, L.J. 1977. Lotus tenuis in Virginia. Castanea, 42: 170-173.

Dorycnium

*Celebioglu, T. 1977. Etudes morphologiques et cytologiques sur especes du Dorycnium de la Turquie. Biyoloji Dergisi 27 (2-4): 1-77.

*Institut de Botanique et de Génétique de l'Université d'Istanbul