Paper 18
CULTIVAR DEVELOPMENT

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INTRODUCTION

Cultivar development, and the history of cultivars in New Zealand up to 1967, has been summarised by Palmer (1967). In contrast to that period of cultivar stability, the period since 1974 has seen the introduction of a number of new cultivars, mainly in response to disease and pest problems. In the same period, the traditional cultivars of the Provence type have declined in their share of the lucerne area. Wairau is still the predominant cultivar, but neither Hunter River nor Chanticleer are now traded, and College Glutinosa has not been produced under certification since the 1977/8 season.

IMPORTATION OF CULTIVARS AND THEIR EVALUATION

Before 1970 the threat of the importation of bacterial wilt (*Corynebacterium insidiosum*) had prevented the large scale importation and evaluation of a wide range of lucerne cultivars from overseas. However the discovery that bacterial wilt was widespread in New Zealand in the early 1970's (Close and Mulcock, 1972; Hale and Close, 1974) made the provision of suitable bacterial wilt resistant cultivars urgent. In the short term there was no alternative to the importation of seed of suitable cultivars.

Thus in the 1970's there were a large number of trials carried out by DSIR, MAF and industry testing imported lucerne cultivars (Palmer *et al.* 1975; Dunbier and Easton, unpubl. data). There were three major conclusions from these trials. First, and of most immediate significance, the benefits of bacterial wilt resistance have been clearly demonstrated in infected situations. This conclusion has resulted in the recommendation for release of the range of U.S. bred cultivars which are now available (Janson, 1979). Second, the trials showed that even in the absence of bacterial wilt many of the imported cultivars performed as well as Wairau overall, and had some advantages over Wairau as in greater resistance to leaf diseases. Third, and perhaps most important in the long term, the trials showed that diseases and pests other than bacterial wilt have important influences on lucerne persistence and productivity.

Largely as a result of these trials bacterial wilt resistant cultivars were added to the N.Z. Acceptable List as follows: Saranac (1974), Washoe (1976), AS13R (1979), Pr 521 (1979), WL 311 (1979), WL 318 (1979), and Pr 524 (1979). In addition cultivars AS13 and Iroquois were imported in 1978 to make up for the shortage of seed of bacterial wilt resistant cultivars. At no stage since the introduction of Saranac in 1974 has the local seed industry been able to supply the demand for wilt-resistant cultivars, and large quantities of certified seed have had to be imported. Saranac is the only U.S. cultivar which has been extensively multiplied in New Zealand from imported "Basic" grade seed.

An extensive series of trials run by MAF and DSIR throughout New Zealand was established in the spring of 1975. Their value in terms of making cultivar recommendations was negated with the arrival of the blue-green aphid (*Acyrthosiphon kondoi*) in the same season, for all commercial cultivars then available were susceptible to blue-green aphid.

A later series of trials has evaluated persistence under farm conditions in the Volcanic Plateau. Although no accurate estimates of production are obtainable under this system, the major differences between cultivars are in persistence. The imported cultivars listed above are performing satisfactorily in these trials.

Direct readings of disease or pest resistance; bacterial wilt, stem nematode (*Ditylenchus dipsaci*), leaf diseases (esp. *Pseudopeziza medicaginis, Leptosphaerulina briosiana*), blue-green aphid and pea aphid (*A. pisum*) and growth pattern and agronomic characteristics have also been obtained in special field or glasshouse tests at either Lincoln or Palmerston North.

BREEDING OBJECTIVES AND METHODS

A number of overseas cultivars have given good performance in New Zealand but it is unlikely that any overseas bred cultivar will prove the best in our conditions, because of the unique interaction of climate, diseases and pests and management systems used in New Zealand. Ultimately cultivars selected here will prove superior.

Cultivated lucerne (*Medicago sativa* sensu lato) is an extremely variable species with a wide natural distribution in climatic conditions as diverse as desert and sub-arctic. However, in New Zealand only a narrow range of genetic material has been utilised so far. In contrast countries such as the U.S.A have utilised a much wider range of material. In part this was due to the range of climatic conditions experienced there, but it has also been due to the search for genetic resistance to insects and diseases. Prior to 1925 in North America, the only lucernes available were "common" types, which had been derived from importations and developed by natural selection, over some generations in particular environments. These "common" strains varied in many characters because of the different selection pressures in each location. For example "Montana common" was much more winter hardy than "New Mexico common", because it developed in the much more severe winter conditions in Montana. These lucernes were derived in exactly the same way as Marlborough lucerne in New Zealand, and performed well until bacterial wilt was discovered in the U.S.A. in 1925.

Since the first bacterial wilt resistant cultivars (Ranger and Buffalo) were released in 1942, virtually all cultivars bred in the U.S.A. have had resistance to bacterial wilt, and over the last 20 years most have also had resistance to a number of other pathogens. In Western Europe where Verticillium wilt (*Verticillium albo-atrum*) is considered to be the major pathogen, most cultivars released since 1960 have had resistance to Verticillium wilt and sometimes to other pathogens as well.

Breeding for pest-resistant cultivars has only begun in New Zealand since the discovery of bacterial wilt in 1970. This country is thus almost 50 years behind the U.S.A. in terms of cultivar development. The recognition that several pests and diseases other than bacterial wilt are also currently or potentially important, emphasises the importance of multiple-pest resistance. We consider that the most efficient way for New Zealand lucerne breeders to make up lost breeding time, is to utilise the results of successful overseas breeding programmes, in developing a suitable resistant germplasm base, and selecting desirable agronomic characteristics from that, rather than to breed all these resistances into "New Zealand common" i.e. Wairau.

There are two lucerne breeding programmes in New Zealand. Crop Reseach Division, DSIR at Lincoln has a long-established programme, aimed initially nationally, but now principally at the South Island. Lucerne's importance in North Island pastoral systems has significantly increased over the last 15 years, and in 1976 Grasslands Division, DSIR, at Palmerston North, established a breeding programme aimed principally at the North Island lucerne growing areas.

In broad terms the objectives of both programmes are similar although the emphasis varies, due largely to the different characteristics of lucerne growing in the two islands. Both programmes aim for appropriate disease and pest resistance characteristics as they are known. Both have as major objectives, resistance to bacterial wilt and blue-green and pea aphids, but otherwise they differ. The Palmerston North programme also concentrates on resistance to leaf diseases, which are a serious problem in warmer and more humid areas. In contrast, the Lincoln programme has emphasised resistance to stem nematode, which is not known as a major problem in the North Island, Verticillium wilt which may be a problem in Central Otago and will place increased emphasis on Phytophthora root-rot (*Phytophthora megasperma*).

Both programmes will also emphasise desirable forage quality and growth patterns to suit the environment. While lucerne leaves retain a high level of digestibility, the digestibility of the stem declines as growth matures (Fletcher, 1976; Thom 1978). It is thus desirable to have a leafy lucerne, although correct management has an important part to play in optimising herbage quality. Suitable growth pattern in relation to climate is also important. In those areas of the country where considerable growth is possible over the period April-September, it is desirable to have potential to achieve this. Both programmes are based on simple recurrent selection, this is the population improvement method used commonly by overseas breeders. Basically, selection is on phenotype, but some progeny testing is carried out in some instances. Germplasm from all over the world has been utilised in both programmes.

The blue-green and pea aphid resistant cultivar Rere is the first cultivar to come out of the CRD programme. Rere is derived from U.S. material and has yielded well in trials throughout New Zealand since 1977. Other potential cultivars are in the "pipeline".

CRD is using three basic gene pools to produce at least three different types of lucerne cultivar. All three gene pools are being screened for resistance to bacterial wilt, and blue-green aphid and pea aphid, but otherwise the pools and the procedures differ.

Cultivars from pool 1 will be for the traditional uses of lucerne on the east coast of the South Island. They will be persistent, perform well under dryland grazing, and have many of the desirable agronomic qualities of Wairau. Pool 1 cultivars will have high resistance to stem nematode, which is an increasing problem in large areas of Canterbury and Otago.

Pool 2 is intended for areas of productive soil, where lucerne is used as a profitable break legume crop in a rotation. These areas may be irrigated and used for lucerne meal or specialist hay production, as well as the traditional lucerne production pattern. Emphasis is on Phytophthora root-rot and stem nematode resistance and productivity, because these stands are not intended to be long-term. They are highly productive for three to four seasons, before the added fertility is exploited through non-leguminous crops.

Pool 3 is for areas where Verticillium wilt is a problem. Emphasis is also being placed on stem nematode resistance and productivity, particularly over the late autumn and early winter.

The Palmerston North programme also has a pipeline cultivar under field plot testing. A selection from WL 311 for resistance to blue-green aphid, is showing promise in trials at a range of sites.

The most important use of lucerne in the North Island is for grazing, often with oversown grasses, on dairy and sheep farms on the pumice soils of the Volanic Plateau. Cultivars adapted to these conditions are the major medium term objective of the Palmerston North programme.

While Verticillium wilt is ubiquitous in the Central North Island, trials on many sites have failed to show Verticillium to be an important factor in loss of lucerne stands there.

Another project is provision of a leafy cool season active cultivar for the warm coastal areas. Good levels of resistance to foliage pathogens will be essential in this case.

The possibility of new pests arriving in New Zealand, or of present ones assuming greater importance, is recognised and both programmes are open to incorporate new objectives. If the use of lucerne in the future extends into new ecological niches, like dry hill country or land where erosion is a problem cultivars with characters to meet these requirements will have to be developed.

CO-OPERATIVE BREEDING PROJECTS

An innovation in the CRD programme in the last five years is the commencement of co-operative breeding programmes. There are two major justifications for such co-operative programmes with overseas organisations. The most important is the capability to screen for diseases or pests which are not present in this country, but which are considered probable entrants. An example is the spotted alfalfa aphid (*Therioaphis trifolii maculata*) which caused tremendous damage in Australia. It is not certain that this international pest will become established as a pest here, but it was considered prudent to get major CRD breeding populations screened for resistance in Australia. These populations now have a level of resistance equal to U.S. resistant material, and should we be faced with the problem here in the future, then much of the breeding work has been done. Additionally, should it be necessary to use areas outside New Zealand for seed production then this resistance will make it much easier to find suitable areas.

The other reason for co-operative projects is to utilise expertise not freely available within New Zealand. An example is a joint programme between CRD and Weibullsholm Plant Breeding Institute of Sweden. CRD is screening a Weibulls population for resistance to bacterial wilt, and in return a CRD population is being screened for Verticillium wilt in Sweden. At the time the arrangement was made, no screening of lucerne for resistance to Verticillium had been carried out in New Zealand. If at some stage Verticillium is recognised as a problem in this country this programme will provide suitable genetic material.

CULTIVAR MULTIPLICATION AND RELEASE PROCEDURES

The New Zealand seed industry has been based on a single cultivar for many years. In these circumstances non-specialised seed production and seed producers have been the rule. Levels of seed production have generally been low and erratic, with major reliance on naturally occurring pollinators, and many seed crops were taken only if hay needs had been met.

When cultivars need to be changed for any reason such a system is inadequate. If new cultivars are to be made available rapidly then specialist seed production techniques are necessary — reliable pollination, rapid multiplication through low seeding rates, and first year seed production. These techniques are slowly gaining acceptance in the seed industry, but it is likely that the New Zealand seed industry's capability will need to be supplemented by overseas produced seed in the short term. However in the longer term, with reliable pollination the New Zealand industry should produce sufficient seed for the nation.

To speed up release of new cultivars, it is possible to get two seed harvests in one year by growing the two crops alternately in the Southern and Northern hemispheres. In an attempt to speed up the availability of Rere, 20 ha of breeders seed was sown in Idaho in April 1979, following harvest in Marlborough the previous month. The effects of rain on harvests, in both Idaho and Marlborough, has largely negated efforts to increase multiplication of Rere but many lessons have been learnt.

Formal decisions for release of new cultivars are outside the control of the breeder. The critical decision is made by the MAF National List Authority. It is the breeder's responsibility to provide all relevant data, including performance and disease resistance, to the Authority. If it is considered that these data show that the potential cultivar is equivalent to one already listed then, provided there is no objection from Federated Farmers or the Agricultural Merchants Federation, the cultivar is listed and can be certified, imported and traded freely.

CONCLUSION

Within the next five years the development of cultivars bred in New Zealand should reduce our current dependence on imported resistant material. The advent of new pests and diseases, and different patterns of utilisation, present a series of challenges to the breeder. In the future, a number of regionally adapted cultivars will be used and exploit different environments better than one single cultivar. As a consequence growers will have an important choice to make when sowing, if they are to get the best possible being highly productive and apparently healthy, to non-productive and weedy in 18 months — 3 years. In other situations, particularly in extensive dryland stands, this change may take much longer. However, once the disease is established, even in a dryland stand, a period favourable for the disease, or unfavourable for the lucerne, can cause rapid stand decline. Some rapid, and so-called unexplained collapses of stands are due to this process.

Most U.S. lucerne cultivars bred over the last thirty years are resistant to bacterial wilt, and the disease is now controlled there by the use of these cultivars. With widespread adoption of bacterial wilt resistant cultivars in New Zealand, the disease will no longer be important.

Verticillium wilt is considered to be an important disease of lucerne in Europe and North America. It is widespread in New Zealand and the 1975/6 survey carried out by MAF and DSIR staff recorded that 67% of the 247 stands examined contained plants with *Verticillium albo-atrum*. However the importance of this disease in N.Z. is not well documented. Dunbier *et al.* (1981) inoculated plants with *V. albo-atrum* and showed that it had much less effect on yield and plant survival than inoculation with bacterial wilt, however there is evidence suggesting that some areas may have a more severe problem with Verticillium than others.

In Europe, and more recently in North America, considerable effort has gone into breeding lucerne for resistance to Verticillium wilt. A number of commerical cultivars resistant to Verticillium wilt have been released in Europe, but none of these also have resistance to bacterial wilt. Cultivars resistant to both diseases should be commercially available in North America in the near future.

Crown-rot is ubiquitous in all but very young lucerne stands throughout the world. It is caused by fungi (including *Fusarium* spp., *Rhizoctonia, Stagonospora, Sclerotinia* and *Phoma*) invading the crown and multiplying in the moist mixture of litter trapped in the crown. The fungi involved vary from place to place and time to time, and this makes breeding for resistance difficult. Crown-rot has not been shown to reduce production. Yield potential may be decreased to some extent by the loss of active crown area, but there is apparently considerable compensatory growth by new stem buds in healthy tissue on the periphery of the crown.

There has not been much breeding for resistance to crown-rot in lucerne. Some cultivars have been released with resistance to Fusarium, and this may reduce crown-rot. However resistance to crown-rot will probably gradually increase with selection, following inoculation with ground-up disease plants. In the meantime management which minimises injury to the crown through trampling or machinery should minimise crown-rot.

During the recent wet winters many lucerne stands have endured extremely wet soil conditions. Many of them failed and the failure has been attributed to "wet feet". In fact, it is probably not just excess water that has killed plants but lack of aeration and Phytophthora root-rot. This disease is active only when soil is wet for a long time, and it may rot off roots completely. When the soil dries out the disease becomes dormant, although other fungi may then come into the roots where Phytophthora had been active. A healthy plant may then produce new roots from above the infection point, and while it may survive it is no longer tap-rooted. Some of the apparently poor performance of lucerne under dry conditions following a wet season, can be due to the loss of the tap-root through Phytophthora root-rot. A number of U.S. cultivars including AS13R, Washoe and WL318 are resistant to this disease, and in areas where the water table level rises markedly these cultivars should be grown.

The other major root/crown disorder in lucerne is caused by the stem nematode or eelworm (*Ditylenchus dipsaci*). Stem nematode was first reported in N.Z. by Morrison (1957) and now is probably the most serious disease or pest of lucerne in North Otago and parts of South Canterbury. Other infestations are in Central and North Canterbury, but there are few serious infestations in Marlborough, Nelson or the North Island. Infested plants are most apparent in the spring and the nematodes may spread rapidly, particularly in those areas where nematodes are present in irrigation water. Stem nematode may cause dramatic decline of stand, under conditions that are favourable for its spread and growth.

Nematicides are effective but uneconomic in almost all circumstances. Stem nematode is a problem in large areas of North America and Europe and many resistant cultivars have been released. Where stem nematode is known to be present on a farm, or in areas where nematode is widespread, then only the nematode resistant cultivars (AS13R and Washoe) should be sown.

A different group of lucerne diseases are those of the stem and leaves. A number of different fungi are involved — including common leafspot (*Pseudopeziza medicaginis*), pepper spot (*Leptosphaerulina briosiana*) downy mildew (*Peronospora trifoliorum*), *Stemphylium* leafspot (*Stemphylium botryosum*) and spring blackstem (*Phoma medicaginis*). The actual loss of production from these diseases in susceptible cultivars can be substantial, particularly with a long interval between harvests or in damp or humid weather. Some assessments have been made, using fungicides to control the fungal diseases, and losses of 16% in forage yield and 45% in seed (Hart and Close, 1976) and 18% in forage yield (Purves *et al.*, 1981) have been reported in Canterbury, with a long interval between cuts. Purves *et al.* (loc.cit.) however showed that with the use of cultivars with resistance to these diseases, or short cutting intervals, these diseases caused little loss.

More important than dry matter losses from these diseases are the raised coumestan levels which result from infection (Morgan and Parbery, 1981; Purves *et al.*, loc. cit.) and their subsequent effects on the reproductive performance (Smith *et al.*, 1979; Kain and Biggs, 1980; Jagusch, Paper 9) of ewes or cows grazed on such lucerne at or just before mating.

Some breeding for resistance to these leaf diseases has been carried out in North America and Europe. Major differences in general resistance to a range of these diseases comes in cultivars or germplasms from different areas. In general, lucernes from humid areas have accumulated considerable resistance over generations, while those from low rainfall, desert areas, have low levels of resistance. Thus cultivars from Northern Europe (Flamande types) or from North-Central or North-Eastern regions of the USA show good levels of resistance to foliar diseases in New Zealand's marine type climate, while cultivars from Mediterranean regions or from South-Western regions of the USA are generally susceptible. The cultivars currently grown in New Zealand range in their resistance to leaf diseases (Table 3) and should be treated accordingly.

RESISTANT CULTIVARS AND STAND LIFE

A large number of cultivar trials have been carried out in New Zealand in the last ten years. They have given several important results. The major practical point is that in the presence of serious diseases (such as bacterial wilt or stem nematode) resistant cultivars persist and produce where susceptible cultivars are eliminated (Palmer *et al.*, 1975; Dunbier *et al.*, 1979; Easton, unpubl. data).

Results from two recent field trials illustrate this. Table 2 shows the survival of lucerne cultivars in a field trial, following inoculation with bacterial wilt. Less than two years after inoculation, more than half of the Wairau plants had died, while the bacterial wilt resistant cultivars Saranac and Washoe retained enough plants for a satisfactory stand. Figure 2 shows how the appropriate combination of resistances is necessary. When infected with bacterial wilt and stem nematode, Saranac, which is resistant to bacterial wilt but susceptible to stem nematode, was significantly reduced in plant numbers, compared to Washoe which is resistant to stem nematode as well as wilt. In this situation Saranac was no better than Wairau, which is susceptible to both bacterial wilt and stem nematode.

Table 2: Lucerne survival (%) 12 and 20 months after inoculation with bacterial wilt.

	12 months		20 months	
Cultivar	Control	Bacterial wilt	Control	Bacterial wilt
Wairau	96 Aa	98 Aa	84 Aa**	44 Bb
Saranac	94 Aa	96 Aa	89 Aa	74 Aa
Washoe	94 Aa	94 Aa	86 Aa	86 Aa

Cultivar means within a treatment followed by the same letter are not significantly different at 5% (lower case) or 1% (upper case) levels.

**Indicates highly significant difference (1% level) between treatment means within a cultivar.

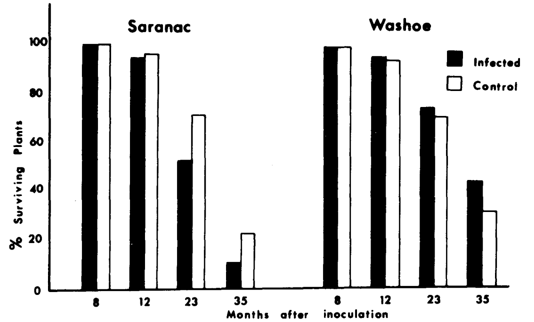

Figure 2: Survival of lucerne cultivars following infection with stem nematode in the presence of bacterial wilt.

In the trials free of major diseases, some of the imported cultivars yielded as well as the New Zealand standard Wairau, and some had added advantages such as better cool season production, or resistance to leaf diseases or aphids.

It would be misleading to consider, however, that all disease problems can be controlled with cultivars available now. Some trials have shown poor performance of all cultivars, unrelated to all known diseases and indicating a local problem which New Zealand breeding programmes will have to solve.

RESISTANCE TO INSECT PESTS

Trought and Kain (Paper 7) have described the effects of the various insect pests on lucerne in New Zealand. In North America much of the lucerne breeding efforts have been to achieve resistance to aphids, particularly spotted alfalfa aphid (*Therioaphis trifolii maculata*) and pea aphid (*Acyrthosiphon pisum*) and more recently blue-green aphid (*A. kondoi*). These efforts have been spectacularly successful, as resistant cultivars have been produced rapidly and saved producers money. However the results from extensive efforts in breeding for resistance to the alfalfa weevil (*Hypera postica*) and the Egyptian alfalfa weevil (*H. brunneipennis*) have not been nearly as successful. No cultivars resistant to these pests have yet been released in the USA.

In New Zealand, as in Australia, rapid progress has been made in breeding for resistance to aphids since these pests arrived in the late 1970's. One aphid-resistant cultivar, Rere, has been released in New Zealand and several more are undergoing field testing and should be released within the next five years. Six aphid-resistant cultivars have been released in Australia following a large expansion in breeding effort there, but these programmes are now being scaled down.

Much less effort has gone into breeding for resistance to either Sitona weevil (*Sitona discoideus*) or white-fringed weevil (*Graphognathus leucoloma*) in New Zealand. Should

TABLE 3: Characteristics of major cultivars available in 1982.

	Characteristic								
Cultivar	Blue-green aphid	Pea aphid	Spotted aphid	Bacterial wilt	Stem nematode	Leaf diseases	Phytophthora root-rot	Leafiness	Autumn-spring growth
AS13R	S	SR	R	R	R	S	R	G	MG
Pr 521	S	MR	R	R	S	SR	S	G	L
Pr 524	S	MR	R	R	S	MR	S	VG	L
Rere	R	R	MR	MR	S	S	S	G	G
Saranac	S	MR	S	R	S	MR	S	VG	F
Wairau	S	S	S	S	S	S	S	G	F
Washoe	S	MR	R	R	R	S	R	G	F
WL 311	SR	R	R	R	S	MR	S	VG	F
WL 318	SR	R	R	R	SR	MR	R	VG	F
Oranga	R	R	R	R	S	MR	S	VG	F

Abbreviations: R = resistant; MR = moderately resistant; SR = slight resistance only; S = susceptible; VG = very good; G = good; F = fair; L = low.

breeding for resistance to sitona weevil prove necessary, then Australian experience in selecting for resistance may prove useful. For white-fringed weevil however, there is no overseas resistant germplasm available and any New Zealand programme would be working on its own. In either case, development of resistant material to these chewing insects would be considerably slower than the production of aphid-resistant cultivars.

CULTIVARS AVAILABLE FOR SOWING IN 1982

A summary of important differences between cultivars is shown in Table 3 and brief descriptions of these cultivars follows.

Wairau:

Standard New Zealand cultivar. Well adapted to New Zealand farming regimes involving combined cutting and grazing. Makes high-quality hay. However, susceptible to all major diseases and pests making its persistence questionable in all but most favourable environments.

Saranac:

On Acceptable Cultivar List since 1974. Bacterial wilt resistant cultivar with somewhat larger leaves and coarser stems than Wairau. Is more resistant to leaf diseases and pea aphids than Wairau, but grows slightly less in late autumn and early spring.

Washoe:

On Acceptable Cultivar List since 1976. Resistant to bacterial wilt, stem nematode, Phytophthora root-rot, and spotted alfalfa aphid; moderately resistant to pea aphid; very susceptible to leaf diseases. In trials, Washoe has yielded 10-15% less than other cultivars in the first 2 years, but has improved from then on, to end up as one of the best cultivars. Has similar seasonal growth pattern to Wairau.

AS13R:

On Acceptable Cultivar List since 1979. Resistant to bacterial wilt and spotted alfalfa aphid, Phytophthora root-rot and stem nematode. AS13R is more productive over late autumn-early spring than any other bacterial wilt resistant cultivar available in New Zealand, but is more susceptible to leaf diseases.

Pr 521:

On Acceptable Cultivar List since 1979. Bacterial wilt and spotted alfalfa aphid resistant cultivar bred in the US. Moderately resistant to pea aphid. Similar to Saranac in winter dormancy.

Pr 524:

On Acceptable Cultivar List since 1979. Bacterial wilt and spotted alfalfa aphid resistant cultivar bred in the US. Moderately resistant to pea aphid. Similar to Saranac in winter dormancy.

Rere:

On Acceptable Cultivar List since 1979. Only cultivar resistant to blue-green aphid and pea aphid. Moderately resistant to spotted alfalfa aphid and bacterial wilt. Shows considerable growth in late autumn and early spring, but less than AS13R. Bred by Crop Research Division, DSIR.

WL311:

On Acceptable Cultivar List since 1979. Bacterial wilt and pea and spotted alfalfa aphid resistant cultivar bred in the US. Same resistance to leaf diseases as Saranac.

WL318:

On Acceptable Cultivar List since 1979. Bacterial wilt, spotted alfalfa aphid, pea aphid and Phytophthora root-rot resistant cultivar bred in the US. As resistant to foliar diseases as Saranac.

Oranga:

Placed on Acceptable Cultivar List in 1982. Resistant to blue-green, pea and spotted alfalfa aphid and to bacterial wilt. Shows less cool season growth than Rere or AS13R but more than Saranac. Bred by Grasslands Division, DSIR.

From these descriptions recommendations of cultivars for particular situations can be made. These recommendations are summarised in Table 4.

Table 4: Cultivar recommendations for specific areas and purposes.

Situation	Cultivars*
Aphid infestations consistent and severe	Rere, WL311 = WL318
Heavy soil where waterlogging is likely, or under heavy irrigation	AS13R = Washoe = WL318
Stem nematode a particular problem	AS13R = Washoe
Lucerne makes good growth in late autumn-early spring, and this production is particularly valuable.	AS13R, Rere
Persistence of lucerne is critical (e.g. very stony soils, very extensive grazing systems)	Washoe
Planned short-term stands	Wairau
In any other situation, any bacterial wilt resistant cultivar will give satisfactory performance and the choice should depend on commercial considerations.	

*Cultivars are listed in general order of suitability of each group. If of equal suitability, cultivars are in alphabetical order.

CONCLUSIONS

Over the decade of the 70's the importance of a range of pests and diseases on lucerne production using the traditional cultivar Wairau was recognised. Imported disease and pest resistant cultivars have overcome some of these shortcomings and the new range of New Zealand bred resistant cultivars coming forward will overcome more. Good management of these cultivars will give excellent results to the grower. The challenge to the grower is to choose the correct cultivar for his situation.

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DISCUSSION

Elliott: Washoe appears to have low production in the early years. Is this related to poor nodulation or Fusarium.

Dunbier: Cultivar trials have shown that in the first two years Washoe yields 85-95% of the trial mean but from then on has produced better than the trial mean even in the absence of eelworm. We have no reason to believe that Washoe has any specific problems in the early years.

Palmer: Why do you not recommend Saranac, Pr 521 and Pr 524?

Dunbier: The recommendations were for specific conditions but in areas with none of these specific problems I mentioned, any bacterial wilt resistant cultivars, including Saranac and Pioneer 521 and 524, can be used.

Brosnan: Is it a coincidence that we have had no aphid problems with AS13R?

Dunbier: Yes, AS13R has no resistance to blue-green aphid.

Douglas: For oversowing should lower producing or higher seedling vigour types be used?

Dunbier: This hasn't been looked at but seedling vigour is probably inversely correlated to production.

Gluyas: Should New Zealand be continuing to grow seed if most of these cultivars are available from USA?

Dunbier: N.Z. should keep competitive but we would be very vulnerable if we went out of seed production.

Janson: Is the lucerne seed industry in N.Z. capable of meeting the challenge of supplying seed of many different cultivars?

Dunbier: It is a big challenge, but in the long-term when pollination is improved the industry should be able to meet the challenge. In the short-term however, imported seed will probably be necessary.