1. PRACTICAL SECTION FOR GROWERS

1.1 Commercial benefits of the project

Downy mildew (*Peronospora destructor*) infection in bulb onions can result in substantial losses in production leading in some instances to complete crop loss. At present there are few chemicals available which can effectively control this disease. Fubol 75 (metalaxyl + mancozeb) is effective in controlling downy mildew but no longer holds approval for control of this disease on bulb onion crops. A new product Fubol Gold, which contains a new formulation of metalaxyl (Metalaxyl M) in combination with mancozeb does not hold approval for use on onion crops. The restricted number of applications of metalaxyl based products and the possible build up in resistance within the downy mildew population are problems, which could result from using only metalaxyl to control this disease. A number of chemical compounds exist which have activity against other species of downy mildew on other crop types. However, little information on the efficacy of these compounds against downy mildew on onions exists. If other existing or new products have activity against downy mildew, these could be used (after gaining the appropriate approval) in downy mildew control programmes. This would have the effect of reducing the reliance on metalaxyl based products and consequently reducing the selection pressure for resistant strains. Field trials were conducted at ADAS Arthur Rickwood to investigate the efficacy of a range of existing and new products to onion downy mildew during 1997, 1998 and 1999.

1.2 Background and objectives

Fubol 75 has now been withdrawn from the market and replaced with a new product 'Fubol Gold'. This product contains metalaxyl and mancozeb however the formulation of metalaxyl used is different (metalaxyl M) and the amount of mancozeb has also been altered. Fubol Gold does not hold approval for control of downy mildew on bulb or salad onion crops. This means that the only metalaxyl based fungicide with approval for use on bulb and salad onions is Folio. Folio contains a mixture of metalaxyl and chlorothalonil. However a new product, 'Folio Gold', is due to replace Folio soon. In this product both the type of metalaxyl and the amount of cholorothalonil in the product will change. It is unclear if these products will be as effective in controlling downy mildew in onion crops as Fubol 75. Heavy reliance on only one metalaxyl based product can cause potential difficulties in future control programmes if it was less effective against downy mildew. The objective of the study was to ascertain if other existing fungicidal products have activity against downy mildew of onions. Specific off label

approval for these existing fungicides could be obtained which would reduce the reliance on metalaxyl based products in downy mildew control programmes.

1.3 Summary of results and conclusions

The fungicide treatments, their active ingredients, application rate, spray number and approval status is shown in Appendix 1.

1.3.1 Field Trials in 1997

In 1997 a field trial comparing the control of downy mildew on bulb onions using existing fungicide products (which do not hold approval for downy mildew control on onions) in comparison to Fubol 75 was carried out.

Test Fungicide treatments

Treatments used were as follows:

(a) Untreated
(b) Dithane945 (5 sprays @ 10 day interval @ 1.7 kg/ha in 200 l water)
(c) Dithane945+Shirlan (5 sprays @ 10 day interval @ 300 ml/ha in 200 l water)
(d) Fubol 75 (3 sprays @ 14 day interval @ 1.5 kg/ha in 200 l water)
(e) Invader (3 sprays @ 14 day interval @ 2.0 kg/ha in 200 l water)
(f) Curzate M (3 sprays @ 14 day interval @ 2.0 kg/ha in 200 l water)

In 1997 Fubol 75 was the main metalaxyl based product used to control downy mildew on bulb onions for which it held approval at that time. Dithane 945, Invader and Curzate M did not hold any label approval for use on bulb onion crops in 1997. However Dithane 945 now holds specific off label approval for control of downy mildew on bulb onions. Disease was introduced into each plot on 18 June 1997 and spread from inoculation points noted on 18 July 1997. Dithane 945 alone and in combination with Shirlan was applied on 18 and 28 July and 6 and 15 of August 1997. Fubol 75, Invader and Curzate M were applied on 18 July, 1 and 15 August 1997.

1.3.2 General conclusions of fungicide trials in 1997

All fungicide treatments with the exception of Dithane 945 slowed the development of the disease in the crop. Unsprayed plots developed high levels of disease quickly. Both Fubol 75 and Invader applied as three sprays controlled disease development however other treatments were less effective. There were higher yields in the 61 - 80 mm bulb onion grade size in fungicide treatments where the disease had been controlled. There was a significant increase in downy mildew disease levels within fungicide treated plots during the harvest interval. The

results of the study indicated that other chemicals exist which possess some limited activity against downy mildew. Other fungicides that have recently been approved for usage under the control of pesticide regulations were considered in field trials conducted in 1998. These included members of the strobilurin group of fungicides such as Amistar and Stroby.

1.3.3 Field Trials in 1998

Of the other fungicides tested in a trial conducted in 1997, only Invader showed enough potential for controlling the disease when applied in combination with Dithane 945 (Kennedy, 1998). There was little effective control of downy mildew when Dithane 945 was applied alone or in combination with Shirlan. Curzate M was not effective in controlling downy mildew in trials conducted in 1997. A further field experiment was carried out, comparing the control of downy mildew on bulb onions using Amistar, Stroby and PF714 (a fertilizer which stimulates the plant's resistance to infection) in comparison to Fubol 75 and Invader.

Test Fungicide treatments

Treatments used were as follows:

(U) Untreated
(1) Fubol 75 (3 sprays @ 14 day interval @ 1.5 kg/ha in 200 l water)
(2) Invader (3 sprays @ 14 day interval @ 2.0 kg/ha in 200 l water)
(3) Amistar (5 sprays @ 14 day interval @ 1.0 litre/ha in 200 l water)
(4) Stroby (5 sprays @ 14 day interval @ 0.1 kg/ha in 200 l water)
(5) PF714 (3 sprays @ 14 day interval @ 3.0 l/ha in 200 l water

In 1998 Fubol 75 held approval for control of downy mildew on bulb onions. Amistar, Stroby and Invader did not hold any label approval for use on bulb onion crops. Product PF714 is a fertilizer and as such does not require approval. Disease was introduced into each plot on 17 June 1998 and spread from inoculation points noted on 24 July 1998. Amistar was applied on 24 June, 6 and 20 July, and 3, and 25 of August 1998. Fubol 75, Invader, Stroby and PF714 were applied on 26 July, 10 and 25 August 1998.

1.3.4 General conclusions of fungicide trials in 1998

Application of Amistar, significantly slowed the development of the disease in the crop and plots sprayed with this chemical had significantly reduced disease severities. Fubol 75 was also effective in controlling the disease and gave the highest numbers of bulbs in the grade size 61 – 80 mm. Other chemical treatments failed to control the disease and had similar yields in the 61 - 80 mm bulb onion grade sizes in comparison to the unsprayed control plots. Bulb yields in the 61 – 80 mm grade size were generally low denoting high downy mildew

disease pressure and indicating that the 14 day application interval used to apply sprays was inadequate if the disease was to be controlled. Invader was less effective in controlling the disease in 1998 in comparison to results from 1997. The impact of Amistar in controlling downy mildew was reduced if used alone. The objective of the final year trials was to assess how Amistar should be used with other chemicals in the control of downy mildew in onion crops.

1.3.5 Field Trials in 1999

Rapid disease development by downy mildew means applying fungicides in a scheduled programme is the only means of controlling the disease. Scheduling fungicide applications requires information on how to use effective products in combination. In 1999 a field trial investigated downy mildew control when approved products (Folio, chlorothalonil) were combined with new products which had efficacy against the disease but were not approved (Amistar). A treatment with Fubol Gold was included for comparison with Folio.

Test Fungicide treatments

(U) Untreated

(1) Amistar 1.0 litres/ha every 10 days (6 sprays)

(2) Bravo 500 2.0 litres/ha every 10 days (3 sprays) followed by Folio at 2.0 litres/ha every 14 days (3 sprays)

(3) Amistar 1.0 litres/ha every 10 days (3 sprays) followed by Folio at 2.0 litres/ha every 14 days (3 sprays)

(4) Bravo 500 2.0 litres/ha then after 10 days Amistar 1.0 litres/ha then after 10 days Bravo 500 2.0 litres/ha after 10 days Amistar 1.0 litres/ha after 10 days Folio at 2.0 litres/ha after 14 days Folio at 2.0 litres/ha.

(5) Amistar 1.0 litres/ha every 10 days (3 sprays) followed by Fubol Gold at standard rate
every 14 days (3 sprays).

1.3.6 General conclusions of fungicide trials in 1999

Disease pressure during 1999 was very high with conditions very favourable for downy mildew development. Incidence and severity of downy mildew on leaf tissues was reduced in treatments where Amistar and Folio/Fubol Gold were applied. However the results suggest that there was less effective control of downy mildew when metalaxyl formulated with chlorothalonil was used to control the disease. Disease increased dramatically after the third week of July in treatments where Folio formed part of the control programme. However, in other treatments, where there was either continuing usage of Amistar or where metalaxyl

formulated with mancozeb (Fubol) was used, disease progress was reduced. The results suggest that Amistar is effective in reducing the spread of the disease within the plot, but is relatively ineffective in eradicating infection once established on the plant. These results confirm the effect of Amistar which was reported in earlier trials (Kennedy, 1999). There were low percentages of bulbs harvested from the 61 – 80 mm grade size in all treatments in the trial reflecting high disease pressures. There was a significantly reduced percentage of bulbs harvested from unsprayed plots in the 60 - 80 mm grade size compared to plots treated with Amistar alone. Plots treated with Fubol Gold had also higher percentages of bulbs harvested from the 51 – 60 mm and 61 – 80 mm grade sizes indicating that this chemical may also have had a beneficial effect on yield.

1.4 Action points for growers

The new product containing Fubol Gold does not hold approval for use on onion crops. Only Folio (with limited numbers of applications) holds approval for control of downy mildew on onions. However the new product containing chlorothalonil and metalaxyl (Folio Gold) will not have approval for use on onion crops. When this happens there will be no metalaxyl based product that can be legally used to control downy mildew on onions. It is therefore important that approval is gained for new products such as Amistar. Strong consideration should be given to obtaining approval for products such as Invader which show some activity against downy mildew. This could be obtained as a specific off label approval for use on onion crops. The usage of a greater range of effective products would also reduce the possibility of the occurrence of fungicide resistance.

At present the limited numbers of applications of Folio to the crop can result in important crop growth stages remaining unprotected from the disease if control sprays commence early in the growth season. An alternative strategy of applying sprays using information from disease forecasting systems may help reduce this problem. However, where disease appears in the crop early as in 1997 and 1998, several applications of fungicides will be required to control the disease. Use of Amistar in control programmes would help to reduce this problem. Different fungicide products used in combination will therefore be required if disease development is to be controlled.

1.5 Anticipated practical and financial benefits

In field trials with downy mildew it has been demonstrated that Amistar is effective in controlling downy mildew on bulb onions. The effectiveness of Fubol in comparison to Folio has also been demonstrated. Although other compounds such as Invader showed some control of downy mildew, in the absence of approval for use of products containing metalaxyl it would be useful to consider obtaining approval for Invader. If Amistar could be used on onion crops the grower would thus have another effective product which could be used to provide reliable disease control. This have the dual benefit of protecting onion yields and reducing the potential for resistance to build up in the pathogen population.