extent of damage due to this pest and to investigate control measures. The capsids found on beet plants were *Lygus rugulipennis* (P) (Hemiptera : Miridae). The plant damage attributed to capsids was confirmed by the use of insectaries in the glasshouse. In the field, damage was due to adult bugs since the first immature capsids were not found until approximately 3 weeks after the season's latest occurring damage was recorded. Where capsids were plentiful, as in some areas of Co. Cork in 1992, 16% to 62% of plants within 7 m of headlands were damaged and 30% to 48% of plants in the open field. On two trial sites, (Carlow area in 1992) 13% and 15% of plants were damaged. Significant reductions in capsid damage were obtained following carbofuran and imidacloprid seed-dressing and when carbofuran-isofenphos microgranules were used. Imidacloprid seed-dressing provided the best control. In 1993, capsid damage was considerably lower than in 1992. However, four out of a total of seven spray treatments did reduce pest damage significantly in 1993. The best control of capsid damage was achieved when insecticides were applied to plants having their first pair of true leaves and when the second leaf-pair were budding. Root yield was greatly reduced due to capsid damage but sugar content was only slightly reduced.

USE OF INDUCED MUTANTS IN FUNDAMENTAL AND APPLIED STUDIES OF PLANT HEIGHT IN WHEAT

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Improvement of complex multigenic traits in wheat breeding is generally achieved as the result of empirical selection, but a better understanding of the impact of specific genes on these and associated traits will lead to the development of more effective selection criteria. The approach being used in this research programme involves the isolation of induced mutants of winter wheat cv. Guardian, altered with respect to a specific character, followed by determination of the mode of action and pleiotropic effects of each mutation. Analysis of altered-height mutants of the semi-dwarf (*Rht* 1) variety Guardian in field microplots revealed correlations between plant height and heading date ($r=0.86$, $P<0.05$), tiller number ($r=-0.47$) and flag-leaf area ($r=0.86$, $P<0.01$). Physical consequences of large leaves resulted in positive correlations between plant height and both leaf angle to the vertical ($r=0.84$, $P<0.01$) and light interception by the crop canopy ($r=0.80$, $p<0.05$). Analysis of 12 near-isogenic mutant lines revealed no significant correlation ($r=0.05$) between flag-leaf area and photosynthetic rate per unit leaf area (Pmax), offering the prospect of developing wheat varieties with increased photosynthetic capacity. Different classes of short-strawed mutants could be distinguished in terms of their response to gibberellins (GA). Mutants with decreased GA-sensitivity (the mutation possibly affecting GA-receptors) such as mutant 111, exhibited multiple pleiotropic effects such as late heading, small leaves and round grains, while mutants exhibiting increased GA-sensitivity (the mutation possibly reducing GA synthesis), such as mutant 1(26), were largely devoid of detrimental pleiotropic effects.

IN VITRO STRATEGIES FOR IMPROVEMENT OF FROST TOLERANCE IN CAULIFLOWER

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Two *in vitro* selection strategies were employed in an effort to obtain cauliflower lines with improved cold tolerance. In the first, an indirect approach, resistance to hydroxyproline was used to obtain lines accumulating proline, a characteristic previously shown to improve frost tolerance in plants. The second approach involved direct selection for survival in frozen tissue. Both strategies were employed with several different regenerating culture systems but the results reported were obtained with curd, which yielded the most efficient regeneration. Mutagenesis was by 0.3 mM nitroso-ethylurea (NEU) applied directly to curd pieces. Effectiveness of this treatment was indicated by a high incidence of chlorophyll deficiency and morphological mutations in regenerated shoots. Thirty-one hydroxyproline-resistant shoots were obtained from several thousand mutagenised curd pieces, while none came from a similar number of non-mutagenised controls. Only one of these showed consistently elevated proline levels and this was less pronounced after 10 to 12 subcultures. Improved frost tolerance could not be demonstrated in plants with proline levels 1.6 times higher than controls, but these

are believed to be chimeras and efforts are now directed at regenerating a solid mutant from the line. One putative frost-tolerant shoot resulted from direct selection for survival after freezing. However, subsequent *in vitro* tests did not show improved frost tolerance. The performance of greenhouse-grown plants of this line is being assessed.

SPENT MUSHROOM COMPOST AS AN ORGANIC MANURE AND PLANT SUBSTRATE COMPONENT

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The effect of adding spent mushroom compost (SMC) to soil on the growth of perennial ryegrass was studied in a pot experiment. SMC raised levels of P, K, Mg and electrical conductivity (EC) but not NO_3-N. At the first cut, growth was increased by SMC at rates up to 50 t/ha but higher rates reduced growth. By the final harvest, there was a positive response up to the highest rate (400 t/ha). The nitrogen efficiency of dry matter production for SMC averaged 3.1 as against 21.1 for calcium ammonium nitrate. Leaching an SMC/peat column with distilled water at 10-day intervals over a 60-day period, recovered 94% of the K in the leachate, 33% of the P and only 15% of the N. When SMC was used as a plant substrate component in combination with peat, initial growth of tomato seedlings did not respond to rates above 5% of SMC by volume. At a later harvest, there was a response up to 20% SMC. When SMC was used as a single nutrient source to supply either P or K, there was no benefit from increasing the rate of SMC above 5%. However, plant growth was increased up to a rate of 25% SMC when it was used as a source of N. There was no response to trace element addition. When an SMC/peat substrate containing 5% SMC, was supplemented with 200 mg N per litre, plant performance was as good as in a 100% peat substrate with inorganic fertilisers.

SEED YIELD AND OIL CONTENT OF *CAMELINA SATIVA*

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Camelina sativa L., a member of the mustard family, is a summer annual oilseed plant. Pilot trials on Camelina in Oak Park in 1991 and 1992 showed that yields of seed and oil were equivalent to those from oilseed rape. The objectives of the present project are to evaluate Camelina as a possible alternative to oilseed rape, to establish yield potential of seed and oil, fatty acid composition of the oil and to establish agronomic guidelines for the efficient production of the crop. *Camelina sativa* (cv. Hoga) was sown in Oak Park on a range of dates from October 1992 to June 1993. The average yield of the autumn-sown crops was disappointing (1.3 t/ha at 9% moisture content) due to high levels of Botrytis disease and insufficient nitrogen applied in the spring. The average yield of the spring-sown crops (2.40 t/ha at 9% moisture content) was consistent with the 2 previous years. Date of sowing had very little effect on yield. Camelina showed a very positive response to nitrogen. Each increment increased seed yield, but had no effect on seed oil content (levels in excess of 440 g kg^{-1} DM in all cases). Spring-sown Camelina has a potential yield of 2.5 t/ha. The fatty acid composition of Camelina seed oil bears a greater resemblance to linseed than to rapeseed oil. The oil contained mainly (g fatty acid per kg oil) oleic (137), linoleic (137), α-linolenic (368) and eicosenoic (162).

EFFECT OF REDUCED RATES OF HERBICIDE ON WEED CONTROL IN WINTER BARLEY

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Due to reform of the Common Agricultural Policy, as well as increasing environmental concerns, there is an urgent need for all crop production costs to be minimised. The objective of a series of trials carried out in Oak Park in 1992 and 1993 was to determine if reduced rates of diflufenican/isoproturon applied at crop growth stage (g.s) 12, followed by a methsulfuronmethyl/mecoprop combination at g.s. 30, would give cost-effective control of annual weeds. The treatments applied (as g active ingredient (a.i.) per hectare) were:- (1) 900 g diflufenican, (2) 450 g diflufenican and (3) 225 g diflufenican. All treatments received a subsequent application of a methsulfuronmethyl/mecoprop (1.5 g + 600 g) combination at g.s. 30. The trial was a randomised block design with four replications per treatment. All herbicides were applied in a water volume equivalent to 150 l/ha at 2.4 bar pres-