Useful Natural Morphological Mutants ?

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In Britain currently-grown winter varieties can exceed 1.5 metres in height on fertile soils with good rainfall. Farmers would prefer shorter-strawed varieties that could be easily tractor-sprayed against insects or *Alternaria* spp. after flowering. The French variety, Rafal, and the new Plant Breeding Institute variety, Mikado, are shorter and plant height may be reduced further in present morphological types by selection. Recommendations by physiologists from field studies and the discovery of different morphological types by breeders indicate that shorter strawed, more cereal-like types, morphologically distinct from present varieties, might be bred with at least similar yields.

Mendham, Shipway and Scott (1981) found considerable seed abortion in lower pods in the canopy and suggested higher yields might be obtained from fewer, well-filled pods at the top of the canopy from plants with a high leaf area index. The number of pods/m² could be reduced genetically by combining two natural mutations. Plants with a determinate number of flowers on the terminal and all other branches were found and were recognised by the last flower on a branch producing a terminal pod. Different true breeding determinate lines have borne from 35 to 70 flowers on the terminal raceme and from 10 to 25 flowers on the primary branches respectively. Determinate flower production should shorten the flower on a branch producing a terminal pod. Different true breeding determinate lines have borne from flowering period. Extreme determinate types can be counter-productive. Another mutation, restricting flower production, develops only three to five primary branches immediately below the terminal raceme, while thin spine-like growths, trumpet leaves or a normal leaf develop in the axils of lower leaves on the main stem. The lowest leaf axils on primary branches can also be blind. However, flowering branches grew from the base of end-row plants on the outside of plots. Although pure stands of this mutant have not been grown yet, it is probable, from the growth of the mutant in mixed stands of spaced plants in rows, 50 cm apart, that branching would be confined to the top of the plant in plant populations of 50 plants/m² and above. A reduction in number of pods/m² might be achieved by combining this mutant with a less extreme type for determinate number of flowers/branch. Such double mutant types should not flower too early as they would be less able to compensate for frost or insect damage or for irregular plant populations.

In a third natural morphological mutant, the terminal raceme is less dominant, the first two or three primary branches arise at about the same level and with lower branches grow to about the same height as the terminal raceme. However the terminal raceme may also be longer or shorter than the primary branches. Such plants have been called mophead. Pods can arise in a tight spiral on the stem to give a compressed head of pods, but the degree of compression varies considerably between plants and sometimes within plants. Similar variation in internode length on the leaf-bearing stem gives very short to tall mophead plants, ranging from 30 to 180 cm in height. Mophead plants make vigorous growth with unfasciated, thick, fairly lodging resistant stems, that sometimes are cracked longitudinally. Variability is a major problem and true breeding lines have not yet been grown in trial to assess their comparative seed yield. At present pod production on secondary branches gives an undesirably dense mop of pods. Combination of the mophead character with absence of primary branches on the middle part of the stem and fewer secondary branches as well as determinate flower number might give a shallow layer of unshaded pods with high number of mature seeds/pod.

The petals shade pods and leaves at full flower causing abortion of seed in lower pods (Mendham *et al,* 1981), so apetalous types are desirable. An apetalous natural mutant in spring rape gives stamenoid petals with 10 stamens/flower, but has distorted leaves and is weak growing. If this association can be broken, this character could be transferred to the proposed fairly short, determinate mophead type.

However, with the exception of the mutant with determinate number of flowers/branch, pure stands of these morphological mutants have not been grown yet to assess their relative yielding ability. Stability may be a problem in the mopheads, while an undesirable association must be broken in the apetalous type and reduced ability to compensate for hazards in the field may limit the value of determinate types. Even if these problems are overcome, it would take 10 to 15 years to combine these mutants into a desirable genotype with the necessary quality and other agronomic characters. Consequently, at present, these morphological mutants only represent interesting, possibly useful, natural genetic variation in the crop.

Reference

Mendham, N.J., Shipway, P.A. and Scott, R.K. (1981) *Journal of Agricultural Science* **96**, 389-415.