C. A. SUNESON

HARLAND *barley*

HARLAND BARLEY, a new population-variety available in 1968 in California, offers definite (and continuing) yield advantages over other feed barleys in commercial use. The new barley is the result of a 40-year breeding program at the Davis campus of the University of California. It shows yield advantages not only over Atlas barley, the traditional standard of comparison, but also over all of its own ancestors. Harland barley was named in acknowledgment of two of its co-developers, H. V. Harlan and Harland Stevens. It is a product of joint research of the University and the Agricultural Research Service of the U. S. Department of Agriculture.

Advantages other than high yields include a wide genetic diversity in resistance to pests and an unprecedented stability in yields. The accompanying graph shows yields increasing with succeeding generations of composite crosses (C.C.). The various crosses shown—from C.C. II to C.C. XVI (the Harland variety just released)—all developed successively higher yields than Atlas.

Harland is the product of a new breeding method—"evolutionary" breeding—which is very different from conventional pure-line breeding. The new method uses a whole diverse population, whereas the former method used only one individual line from a population. A single line may give high yields immediately, but the yields are at a ceiling, whereas a diverse population can improve progressively in productivity (as in finance, a "growth" stock, as opposed to a "preferred" stock).

A general understanding of population dynamics is important to an appreciation of the new breeding method. Take, for example, the experience with two of the composite crosses involved in the development of Harland. In C.C. II, yields from the second generation were increased by about 45 percent in the 38 years between the second generation and the fortieth. C.C. XVI, on the other hand, started out about 15 percent more productive than C.C. II (because of "better" parents) and by the twelfth generation was already as productive as the fortieth generation of C.C. II, its oldest ancestor (largely from more heterozygote persistence).

Harvests from first commercial plantings of Harland will show mean yields exceeding the yields of most varieties presently grown in California. In addition, annual yield ranges for this variety will be only half the usual average. By 1979 Harland could be expected to gain another 10 percent in productivity.

This continuously improving adaptiveness of Harland is the important factor for consideration in making a decision as to what barley to plant. Progressively greater yields are possible for growers who will become independent practitioners of evolutionary breeding. In fact, after starting with Harland it is advisable for growers to continue this breeding program rather than buying seed elsewhere. To obtain maximum benefits from evolutionary breeding, the long-range production must be kept pure, and growers who embark on evolutionary breeding must avoid drastic shifts in soil types, seeding rates, seeding dates, fertility, salinity, latitude, altitude, or in the continuing level of natural crossing.

As released, Harland will have a trace of 2-row, black, naked seed. The population will show a two-week range of maturity. The seeds and heads will be predominantly large, but diverse in size, shape, and color. Its composite reaction to diseases and shatter will be impressive. About 40 percent of its plants will classify as "hybrid barley." Initially, Harland is being recommended only in the area from Fresno to Red Bluff—and in no case outside of California.

Breeders' seed will not be kept essentially "as released," but will be under continuous generation advancement through early winter sowing each year at Davis by the California Crop Improvement Association. Certified seed will be under a generation limitation because of wide soil and climate diversities in California.

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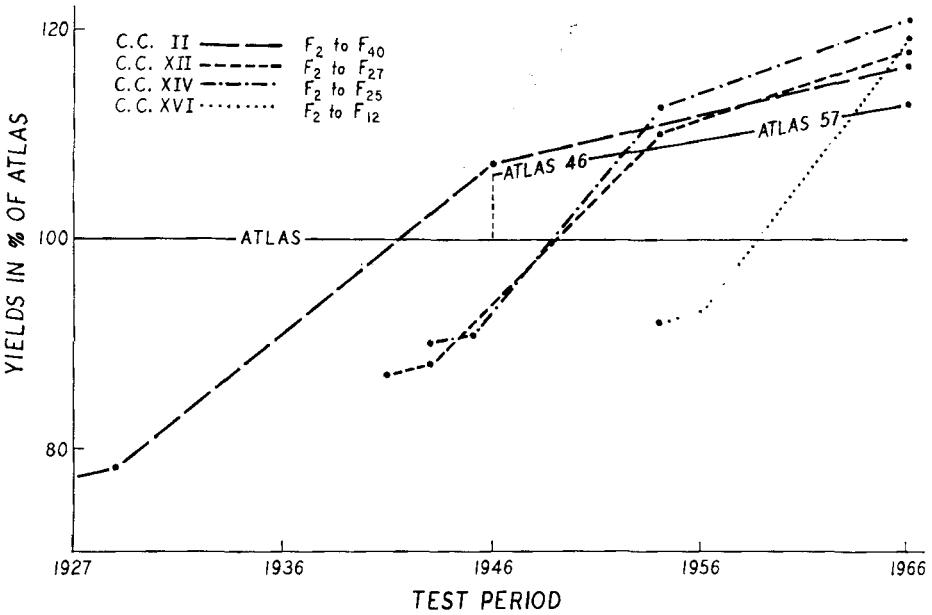
HARLAND-ATLAS YIELD COMPARISONS AND COMPOSITE CROSS INCREASES



The standard of comparison, Atlas barley, is shown (through backcrosses) to have increased in yield by 13 per cent during the 40-year period 1927–1966. Even so, all the composite cross (C.C.) populations in later generations are shown to be superior in yield to Atlas 57, "the most backcrossed cultivar." Comparisons between succeeding C.C. lines show that both the early and late generations were superior to predecessor lines in the same generation. Greater adaptability and more intercrossing of the parents account for this superiority. Thus, C.C.II had 9/28 poorly adapted parents, whereas C.C.XIV had only 1/9 "poor" parents. C.C.XVI resulted from "persistent survivors" in the older populations. Besides C.C.II, XII, and XIV, these also included C.C.V and XV which closely paralleled C.C.XII and XIV in performance.