In the breeding of beans for the production of edible pods, many characteristics of the desired phenotypic condition are in direct conflict with natural selection, as well as selection for other economic uses. As with the domestication of other plants for man's use, the snap bean is the combination of many and usually recessively-inherited alleles, a combination of genetic factors that has required years of effort to successfully bring about. Pods of snap beans are selected for shape, length, color, smoothness, straightness, spur character, interior color, internal firmness, fleshiness, stringlessness, freedom from sidewall fiber, texture, shipping quality, processing quality, and eating quality. In addition, the snap bean breeder must be concerned with pod detachability, pod placement, pod yield, and pod harvestability. Then we add all the other characteristics that other types of bean breeders are concerned with: plant characteristics, seed characteristics, seed yields, maturities, disease and insect resistance, geographical adaptation, etc. When one considers the time and effort required to establish the desired snap bean genetic condition, one can appreciate why the commercial snap bean breeder loathes the thought of crossing with anything less than another snap bean genotype. The commercial snap bean breeder only infrequently makes use of non-snap bean germplasm.

The main sources of the germplasm of commercial snap bean programs can be listed as follows:

1. Proprietary varieties and pedigreed lines of the seed company employing the breeder.
2. Snap bean varieties and breeding lines from outside sources.
3. Non-snap bean varieties, breeding lines, and collections.

1. Proprietary varieties and pedigreed lines of the seed company employing the breeder.

D.M. Ferry Company of Detroit, Michigan, and C. C. Morse Co. of Santa Clara, California, began their existence at the same time that Gregor Mendel was observing segregation in F2 progenies of garden peas and documenting his laws of heredity in the decade of 1870. Records of both D.M. Ferry and C.C. Morse indicate active bean breeding programs in the 1920's, but limited to single plant selection from named varieties. Ferry-Morse Seed Company came into existence from the marriage of D.M. Ferry Company and C.C. Morse in about 1930. Present Ferry-Morse records indicate that the first crosses made for obtaining segregating F2 progenies occurred in 1936. These crosses were all between named varieties of that period.
From this basic germplasm pool began in 1936, utilizing the pedigree method of breeding, the breeder of that time selected various pedigreed lines. Some became named varieties, but most were carried on by recrossing between the pedigreed lines or by crossing with named varieties. Even now, pedigreed lines of 1983 in some instances still can be followed back in their pedigrees to these original crosses. This basic germplasm pool still contributes genetic factors to the Ferry-Morse bean breeding program.

2. Snap Bean varieties and breeding lines from outside sources.

Prior to 1940, varieties contributing new germplasm into the original pool were essentially varieties and selections in existence for a number of years previously. Two exceptions stand out: U.S. #5 Refuge, a U.S.D.A. release in 1935 was a mosaic virus resistant bush type, and Idaho Refugee of Walt Pierce and J.C. Walker, also a mosaic resistant bush type released through the University of Idaho in 1934.

Starting in 1947 a small but steady release of new varieties began to occur from both seed companies and public agencies. These were rapidly incorporated into the germpool by crossing with pedigreed lines of the time, steadily expanding the germplasm base. It is recognized that often seed company varieties were just a re-working and re-selection of genetic combinations already existing in the germplasm pool. The public varieties, however, quite often brought in disease resistance genes in combinations not previously available.

This process is still followed. Public breeders continue to release varieties but in lesser frequency while continuing to be an extremely valuable source of new breeding lines. These lines are constantly being brought into the seed companies' breeding programs in crosses with their pedigreed lines.

We can summarize this section on sources of snap bean germplasm by listing the major sources existing today.

<table>
<thead>
<tr>
<th>Source</th>
<th>Description of Snap Bean (P. vulgaris) Germplasm</th>
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<tbody>
<tr>
<td>Private Seedsman (Domestic and International)</td>
<td>-highly adapted, economically important genetic combinations: Varieties.</td>
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<tr>
<td>U.S.D.A. - Prosser, Washington</td>
<td>-resistance to curly top, mosaic viruses, Fusarium resistance, Blue Lake and Tendercrop-type bush lines.</td>
</tr>
<tr>
<td>U.S.D.A. - Beltsville, MD</td>
<td>-Rust and air pollution variety screening.</td>
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BEAN VARIETY AND GERMPLASM EVALUATION IN COLORADO

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INTRODUCTION

Dry beans, primarily Pintos, are an important crop throughout irrigated and dryland regions of Colorado, and occupy 125-200,000 acres (50-80,000 hectares) annually. During the last five years, irrigated yields have ranged from 1600-2200 lbs/acre (1800-2400 kg/hectare) and dryland yields have ranged from 150-500 lbs/acre (170-560 kg/hectare). Crop productivity has been affected by various constraints during this period including diseases, insects, drought, high temperature, and by genetic limitations inherent within older and existing varieties.

Bean Improvement Objectives

Our bean program is using a multidisciplinary approach to improve and stabilize the genetic potential of dry bean varieties and market types grown in Colorado and surrounding regions. Program objectives include: the introduction and evaluation of exotic bean germplasm from