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Mechanical Damage to Dry Beans
Michigan State University
Cooperative Extension Service
Farm Science Series

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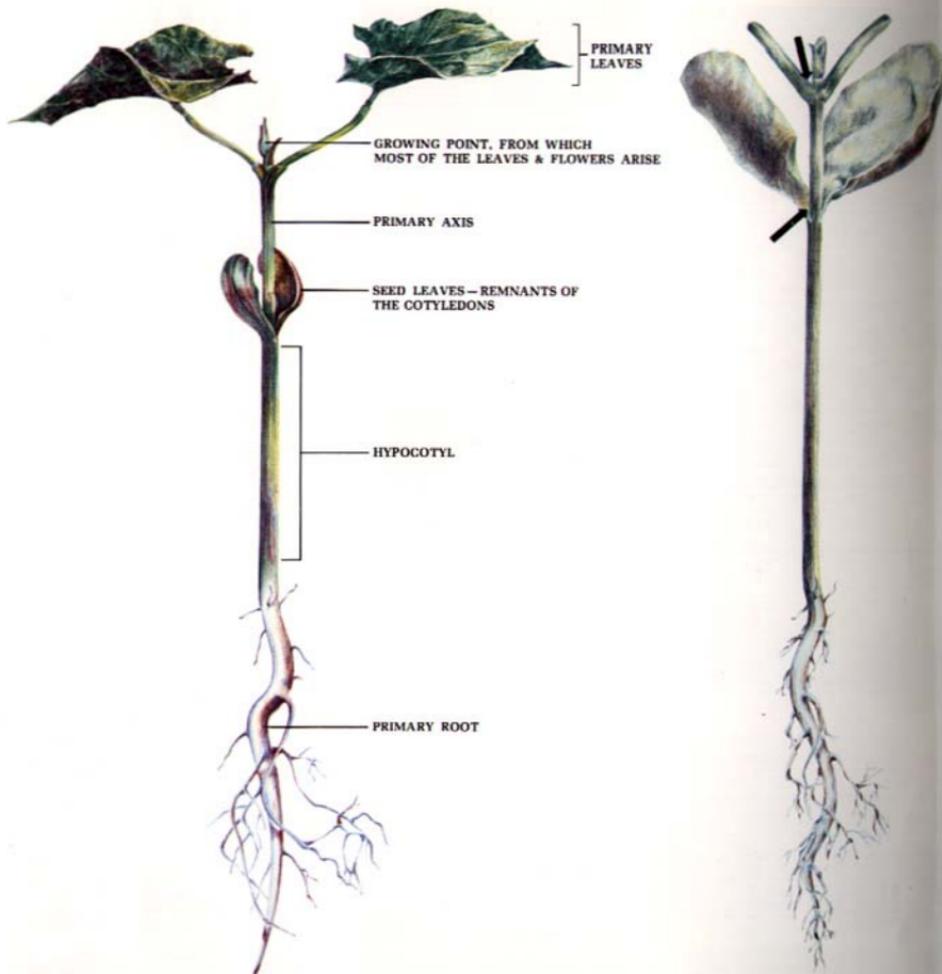
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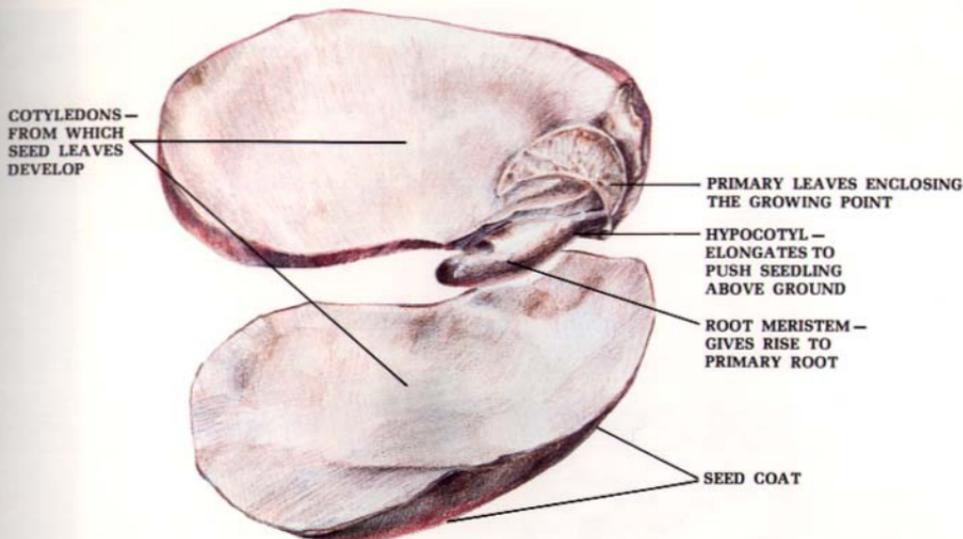
MECHANICAL DAMAGE TO DRY BEANS

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Left, a "normal" seedling, as it would appear at about 10 days after planting. New growth comes from elongation of the growing point and from development of axillary buds along the main axis above the "seed leaves" (cotyledons). **Right**, a typical "bald-head" seedling. The loss of both primary leaves and a broken tip at the growing point, due to mechanical abuse of the seed,

seriously affects the ability of this kind of seedling to establish itself. Furthermore, its vigor is adversely affected and development retarded—should it survive. Since new vegetative growth can come only from dormant buds at the first and second nodes (arrows), plant development will be retarded, flower and pod formation drastically reduced, and yield consequently lowered.



A red-kidney seed opened up to display the basic parts upon which growth depends. Injury to any one of these parts will result in a defective, slow growing seedling.



The role of man, machines and moisture is critical in restricting damage to beans. More care in harvesting and handling will significantly reduce dry bean damage. Likewise, some strains of navy-type and red kidney beans are more resistant to low moisture damage than others. The experimental variety, **left**, suffered only

6% damage at the relatively low moisture of 13%, while the other variety, **right**, resulted in 52% damage at the same moisture content. It appears feasible to transfer this desirable attribute to commercial bean varieties through continued plant breeding.

MECHANICAL DAMAGE TO DRY BEANS

Information Contributed by Cooperative Extension Service and Agricultural Experiment Station of MSU, and U.S.D.A., with the Cooperation of the Michigan Bean Commission.

Modern harvesting and handling machines and the widespread use of the early-maturing bush beans have made mechanical damage to bean seeds a serious problem. The problem is intensified in years of dry, bright, warm weather at harvest. Damage that begins on the farm is compounded at the elevator, in transport during changing weather (temperature and humidity) conditions, and in processing plants as the beans are prepared for canning.

Losses in split and broken beans and in lowered quality of the canned product, due to the inclusion of checked and loose skins, can be enormous. All who handle dry beans should become aware of the potential for damage, so that proper care can be taken in every mechanical operation. The accompanying illustrations emphasize: 1) the sources of mechanical bean damage — from production to processing and 2) the consequences of these damages.

Production



Mechanical damage to beans takes two forms—breakage of skins and cotyledons, and loss of, or injury to, parts of seedlings which develop from damaged seeds. The latter condition is apparent only upon germination. The effects are always the same—loss of one or both cotyledons or primary leaves. The growing point has been damaged so severely in the “bald-head” plant (right) that it does not function to produce a normal plant.



Damaged bean seed results in thin field stands with poor growth and vigor. Furthermore, seedlings that have managed to retain all standard parts, and initially appear to be normal, are usually less vigorous and thrifty than seedlings from undamaged beans. The low moisture seed on the left was dropped 30°; not dropped (right).



The competitive ability of plants from damaged seed is greatly lowered. Injured seed will result in an unthrifty, irregularly-maturing, and lower-yielding crop.



Undamaged seeds produce normal vigorous seedlings, that result in full stands, rapidly developing plants, and productive fields at harvest time.



Harvesting



Foreign material and dirt in the beans (left) mean extra cleaning and handling at the elevator. This adds to the damage, especially when beans are at low moisture levels.

If the soil is in a dry, pulverized condition when beans are pulled, the action of the windrower will shake-off most adhering soil particles. The field should be kept weed-free since the roots of many immature weeds will cling tenaciously to soil clumps at harvest.



Under very dry conditions, the combine should be running at the slowest possible cylinder speed needed to separate seed from straw. It is even better to postpone threshing during hot, dry afternoons to mornings or mid-day periods when the beans have some surface moisture. Conditions are right for bean damage (left) as indicated by the huge cloud of dust. When feasible, beans should be pulled before they dry down to a low moisture level. Raking beans into large fluffy windrows so that a large volume of straw enters the combine will help protect beans from impact damage (right).

Handling



Beans properly handled through growing and harvesting end up as bright, clean, and whole beans in the bin or silo. Nothing less is really satisfactory. Now, it is the responsibility of the elevator, the shipper, and the processor to maintain wholeness and cleanliness of the bean.



Those who handle beans at the elevator and in transport should regard them as fragile, especially at moisture content of 15.5% and less. Beans can be damaged by dropping them onto floors of storage silos, running them through cleaning equipment and conveyors at high speed, handling at low temperatures and bulk handling with improper equipment. Extreme mechanical damage can result in 'splits' (right) which must be screened out.



Rough handling at dockside and aboard vessels for overseas shipment is a further cause of damage. Such damage, however, can be minimized through reasonable care.

Processing



Typical damage to navy beans includes chipped and checked seed coats. Further "dry" handling by the processor leads to additional damage—the checked seed coats become loose skins, and some become splits. Minute cracks become obvious checked skins. During the soaking phase of final processing, loose skins often separate completely from the seed. When further processed, split seeds can become mushy as the solids are released into the surrounding fluids. Compare the damaged beans before and after processing (above) with the undamaged beans (below). The damaged beans produce a highly disintegrated and unattractive product, while undamaged beans retain wholeness when canned.



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