Removal of immature and over mature flowers

Removal of calyx and petals

Removal of stamens, keeping only pistil

Pollination by touching anthers of male parent

Tagging with name of cross (female x male)

Bagging

Harvesting of seed

The successfully pollinated flowers will soon develop seed pods (siliquae) that will carry viable seeds. When pods become mature enough but have not yet opened to scatter seeds, they should be harvested, threshed, cleaned and stored in paper pouches at a cool, well ventilated and dry place till sowing.

Pod formation in successfully pollinated flowers

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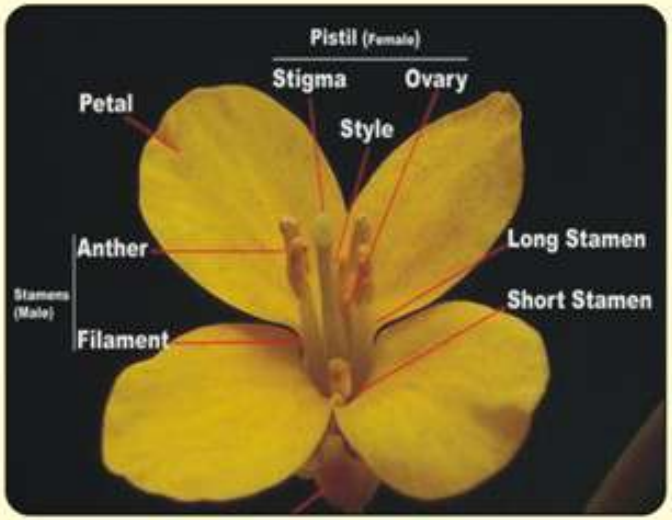
Published by:
Director
ICAR-Central Institute of Temperate Horticulture
Old Air Field, Rangreth Srinagar-191132 (J&K)
Ph: 0194-2305044

First Edition: 2018

Printed at:
MIR ADVERTISERS, Rambagh
Cell: 9906527474

ICAR

Seed Production Technology in Major *Brassica* Vegetables of Kashmir



Geetika Malik
Sajad Un Nabi
W. H. Raja
Anil Sharma
D. B. Singh

ICAR-Central Institute of Temperate Horticulture
Old Air Field, KD Farm, Rangreth-191132
Srinagar-(J&K)

Introduction

Brassicas that include kale, knol-khol, cauliflower and cabbage are among the most commonly cultivated vegetables in Kashmir. These are highly cross pollinated crops and plenty of hybrids are available in the market, which are not only expensive but also inflict a continual dependence for seed on farmers. If farmers are capable of propagating their heirloom or farmer varieties, which are increasingly diminishing, and experimenting with hybridization among them or popular varieties, they may very well be able to preserve them and even create newer varieties in the convenience of their fields or kitchen gardens. With this objective in mind, seed production technology in these crops has been briefly demonstrated in this publication. It will also be beneficial for students, kitchen gardeners and others.

Selection of plant

The selection of plants for seed production can be done from within commercial crop field or a crop especially for seed production can be grown. For production of true-to-type seeds, select plants with head/curd/knob/leaf and plant characteristics true to the varietal type. If the aim is production of hybrid seed, then select the parental plants according to the need, e.g. one parent with large head/curd/leaf size and the other with early heading/curding/leafing or one parent with frost/heat tolerance and other with high yield. In any case, the selected plants should be vigorous, disease and insect-pest free. Also there should not be any symptom of environmental stress like wilting, nutrient or water deficiency or frost/heat injury. The selection should be done at the time of commercial maturity of the crop and selected plants be tagged properly.

In-situ method (seed to seed) of seed production

The selected plants are retained where they are in the field. However, they are partially protected with straw mulch or soil that is carefully spread over the plants keeping the tops of heads/curds/knobs bare. Plants can also be uprooted and placed at same location, as it has shown good results in many cases. However, they need to be dug in soil again just before dormancy breaks. *In-situ* method is suitable where winter temperature is not sub zero. Stumping or scooping (removing head or curd core keeping growing point intact) operations or cross cuts on cabbage heads can be done before protecting them or when spring arrives and temperature rises considerably so as to break dormancy (end February to mid March in Kashmir).

Stumping in cabbage

Scooping in cauliflower

Replanting method (head to seed) of seed production

The selected plants are uprooted and stored in trenches, cellars or containers till the time of replanting them in field. It is highly recommended for areas where winter temperature falls to sub zero scales for several days together. Stumping or scooping can be done after uprooting or when the optimum weather conditions conducive for plant re-growth arrive. Similarly leaves are removed from knobs and main stems of knol-khol and kale.

Selfing for producing true-to-type seed

This is done to propagate the variety a farmer is already using and is satisfied with its performance. All the Brassica crops are highly cross pollinated and require an isolation distance of at least 1 km radius from surrounding Brassica fields of even different species. Since, with very small land holdings and location of neighboring farmers' fields in close vicinity, such large isolation distances can't practically be maintained, selfing can be facilitated by selfing bags.

The inflorescence on the bolted plants is properly covered with the selfing bag well in time before opening of any flower/protrusion of stigma from unopened flower. This is done on several plants. The seeds from all these plants are then pooled to avoid inbreeding depression in further generations.

Removal of opened flowers

Covering with perforated selfing bag

Securing the selfing bag with pin

Crossing for producing hybrid seed

Crossing is done when farmer is interested in combining two or more traits from two different varieties to obtain a hybrid. However, it does not assure success in realizing the anticipated hybrid, which eventually depends on crop's genetics. For crossing, few simple implements are required that include pointed forceps, tags/labels, pencil, selfing bags and a simple lens (optional). In most *Brassica* vegetables, emasculation and pollination is done in bud stage because natural pollination occurs even before flower opening. Secondly, in many of these crops the stigma protrudes well before flower opening and carries the probability of being pollinated by random pollen. The procedure of crossing that includes selection of suitable bud, emasculation and pollination, tagging and bagging is demonstrated below.

Proper bud stage