KNOL-KHOL

BOTANICAL NAME : *Brassica oleracea var. gongylodes*
COMMON NAME : Ganth gobhi or kadam
CHROMOSOME NO : 2n=2x=18
FAMILY : Cruciferae

AREA AND PRODUCTION

- Knol-khol is not very widely grown in our country except in Kashmir, West Bengal and some of South Indian states.
- Since in India, it is grown on very small area, hence, exact statistics, regarding area, production and productivity is not available.

ORIGIN AND HISTORY

- It is reported to have originated in Mediterranean center of origin.
- It was developed in Northern-Europe in the fifteenth century.
- According to Encyclopedia Britannica, khol rabi was first described in eighteenth century as another cabbage of European origin.

CLIMATIC REQUIREMENTS

- Though in temperate countries, early bolting is a problem, especially in early cultivars, yet this doesn't seem to be of much significance under Indian conditions with only two cultivars that are generally grown commercially.
- Early maturing varieties have a problem of premature bolting at 12-14^{0}C and require above 15^{0}C temperature for cultivation.
- Seeds germinate well at 15-30^{o}C.
- The temperature of 18-25^{0}C is considered to be optimum.
- Duration of vernalization and stage of growth has significant effect on bolting.
- If the low temperature occurs at early stage of growth for considerable time, the plant will start bolting quickly.
- The occurrence of long oval knob in some varieties with round or flat round tubers is an indication of vernalization effect on tubers.

SOIL CONDITIONS

- Knol-khol can be grown in all types of soils but the fertile soils produce good quality uniform sized knobs.
- It can be grown in wide range of sandy soils.
- Early cultivars grow well in light soils, where as late maturing ones perform better in heavy soils.
- However, well drained soils give higher yield.
- The optimum pH of the soil for knol-khol cultivation is 5.0-6.8.
- Most of the knol-khol varieties are somewhat tolerant to salt.

- In saline soils, plant show die-back of leaf margins and dark foliage and become more susceptible to disease like blackleg.

VARIETIES AND CULTIVARS

Early Purple Vienna:

- Leaves are purplish in colour.
- The knobs are globular to round large in size, purple skin with light green flesh.
- It takes 55-60days for knob formation.

Early White Vienna:

- It is an early variety.
- Plants are dwarf, short topped having medium green foliage.
- The knobs are globular to round.
- Flesh is tender and crisp.
- It takes about 50-55days for knob formation after transplanting.

Large Green:

- It is a late variety with vigorous growing plants and dark green foliage.
- It has flat round and green knobs. It has been found quite suitable for growing in Himachal Pradesh.

Purple Vienna:

- It is a late variety having purple coloured leaves and stems.
- Knobs are big in size with purple coloured spots.
- Knobs become ready for harvesting in 55-60days after transplanting.
- An average yield of this variety is 150-200q/ha

King of North:

- It takes about 60-65days to harvest after transplanting.
- It has dark green, flattish round knobs.
- Dark green leaves are well spread over the knobs.

White Vienna:

- It is an early variety.
- Plants are dwarf, short topped having medium green foliage.
- The knobs are globular, round, crisp and having tender flesh.
- It takes about 50-55days to harvest stage after transplanting.

Palam Tender Knob:

- Early variety with light green knobs and gives average yield of 250-275q/ha.
- Better shelf life.
- Average yield of Knol khol varieties is 200q/ha

CULTURAL PRACTICS

NURSERY MANAGEMENT

- Knol khol is basically a transplanted crop and the procedure is similar to that of cabbage and cauliflower.

TRANSPLANTING

- Normally, the seedlings become ready for transplanting in 4-6weeks after sowing.
- After hardening and before uprooting of seedlings for further transplanting, the nursery beds should be watered to make soil wet.
- This will minimize the root injury when the seedlings are uprooted and fast establishment of seedlings.

SOWING TIME

Planting Time: Under North eastern plains.

	Seed sowing	**Transplanting**
Early crop	August	September
Main crop	September	October
Late crop	October	November

SEED RATE

About 1000-1500g seed is required to raise Knol khol crop in one hectare area.

SPACING

- The planting distance may be 30-40cm from row to row and 20-25cm from plant to plant, according to the variety, soil fertility and intercultural operations.
- When planted at closer spacing, the knob size may be reduced and shape may be elongated.

NUTRIENT MANAGEMENT

- Quantity of manure, nitrogen, phosphorus, and potash should be given as per the nutrients available in the soil, which is determined by soil test.
- Well decomposed FYM@ 100q/ha should be mixed thoroughly in the soil before planting.
- The nitrogen, phosphorus and potash are applied in the ratio of100:60:40-60kg/ha, respectively.
- Entire quantity of FYM, phosphorus and potash and half quantity of nitrogen should be applied at the time of field preparation time.
- The remaining half quantity of N is top dressed 30-40days after transplanting.

WATER MANAGEMENT

- Knol-khol plants are very sensitive to soil moisture stress.
- When plants face shortage of water during the early stage of growth. The initiation of knobs swelling will be delayed and yield will be reduced if the water is insufficient at this stage. This cannot be reversed even if plentiful of water supply is given at the later stages of the growth for higher yield.
- At least six irrigations must be provided during entire growth period which will come out to be nearly 300mm water.
- Knol-khol is generally irrigated by furrow method of irrigation, but excessive irrigation in early stages causes superficial rotting of knobs and washing of the nutrients.
- Late crop is irrigated at 10-15days interval depending upon the weather conditions..

INTERCULTURAL OPERATIONS

- The regular intercultural operations are required to keep the crop free from weeds and to raise a healthy crop.
- Two to three weedings are required.
- Weeds can also be controlled by pre-plant application of weedicides like Lasso @1.5-2kg/ha a.i./ha
- Earthing up is essential to cover the exposed roots and for this, one or two hoeing should be done.

HARVESTING

- The harvesting should be done before the knob gets over mature.
- The over mature knobs have poor edible quality because of more fibre content.
- Usually the knobs may be harvested when they are of 6-8cm diameter.
- In late maturing varieties, sometimes, bigger knobs of 10-12cm diameter are also harvested.
- For harvesting, the stem is cut just above the ground or can be pulled easily by hands.

YIELD

- The yield of this crop varies with the variety, climatic conditions and as per the management practices.
- The yield per hectare varies from 12-30tonnes under Indian conditions.
- Individual tuber may weigh 200-250g

STORAGE

It can be stored successfully for 25-30days below 2oC at 95-100per cent RH.

SEED PRODUCTION

Method of Seed Production

- The seed of Knol-khol is usually produced by *in-situ* methods.
- The transplanting method however, may be practiced to raise the nucleus seed.

In-situ method

- The crop is allowed to over winter and produce seed in its original position where they were planted at the seedling stage.

Transplanting method

- In this method the mature plants are uprooted during autumn.
- The leaves all around the knob and top are removed keeping in crown intact.
- The selected true to the type of the knob, is pushed into the soil, so that knob almost touches the soil.
- Follow all cultural practices (as in case of table crop) to ensure a good crop stand.

Pollination

- Like other cole crops, knol-khol is a naturally cross-pollinated crop due to sporophytic self-incompatibility.
- The pollination is generally done by bees and flies.

Roguing

- Selection of knobs is done during February to March, when the knobs are well developed only true to type plants are retained.
- Off-type and diseased plants are removed.
- Subsequent roguing is done at flowering stage.
- Care is necessary in nucleus seed production to select right type of plant at the time of flowering stage.
- Remove all undesirable plants.
- Subsequent roguing of off type, diseased plants affected by disease such as phyllody, black leg, soft rot and leaf spot may be done from time to time as required.

Harvesting and Threshing

- Knol-khol start seed stock elongation from last week of March onwards when mean temperature rises to 10-13^{o}C.
- Flowering and pod formation starts during the last week of April at the mean temperature of 13-18^{o}C.

- From end of April to end of May, the crop is in full flush of fruiting and flowering.
- The ripening of pods commences by last week of June and harvesting continues up to 1st week of July.
- At the mean temperature below 20oC during June and July, maturity of crop is delayed at least by fortnight and harvesting may continue up to June end.
- To avoid shattering of the seed whole crop is harvested in 2-3lots with sickles.
- Generally, early plants are harvested first, and when the pod colour is brown and about 60-70per cent of the rest of the crop changes to yellow brown, it is harvested completely and piled up for curing.
- After 4-5days, it is then threshed with sticks and sifted with hand sifters.
- After thorough drying, seeds are cleaned and stored.

Seed Yield

- Seed yield is about 500-650kg/ha.
- Seeds are round, 1.5-2.0mm in diameter and brown in colour.
- One thousand (1000) seed weight is about 3.2g.

SEED CERTIFICATION STANDARDS

Field Inspections

A minimum of three inspections should be done, first before the marketable stage, the second at marketable stage and third at flowering stage.

Isolation:

- Seed fields should be isolated from the contaminants shown below:

Contaminants	**Minimum distance (Meters)**	
	Foundation	**Certified**
Fields of other varieties	1600	1000
Fields of the same variety not conforming to varietal purity	1600	1000

B. Specific requirements

Factors	**Maximum Permitted (Per cent)**	
	Foundation	**Certified**
Off types	0.10	0.20
Plants affected by seed borne diseases	0.10	0.20

C. Seed Standards

Factors	**Standards for each class**

	Foundation	**Certified**
Pure seed (minimum) %	98	98
Inert matter (maximum) %	2.0	2.0
Other crop seeds (maximum) Number/kg	5	10
Weed seeds (maximum) Number/kg	5	10
Germination (minimum) %	65	65
Moisture (maximum) %	7.0	7.0
For vapour-proof containers (maximum) %	5.0	5.0