ONION

SCIENTIFIC NAME : *Allium cepa* L.
COMMON NAME : Pyaz
FAMILY : Alliaceae
CHROMOSOME NUMBER : 2n=16
ORIGIN : South East Asia

IMPORTANCE AND USES

- The green leaves and immature and mature bulbs are eaten raw
- Used in preparation of sauces, soups and seasoning of food on account of its special characteristic pungency.
- Also used in processed form e.g. flakes, powder and pickles.
- Onions are diuretic, applied on bruises, boils and wounds.
- Relieves heat sensation.
- Bulb juice is used as smelling on hysterical fits in faintness.
- Used to relive insect bites and sour throat.
- Results of investigation suggested that onions in the diet may play a part in preventing heart diseases and other ailments.
- Onions are given in jaundice, spleen enlargement and dyspeptic after cooping in vinegar.
- In malarial fever, they are eaten twice a day.
- Roasted onion mixed with cumin, sugar candy and butter oil are a demulcent of great benefit in piles.
- The essential oil contains a heart stimulant, increases pulse volume and frequency of systolic pressure and coronary flow and stimulates the intestinal smooth musculature and the uterus.
- Reduces blood sugar & has lipid lowering effect.
- Pungency in onion is due to an enzymatic reaction only when tissues are damaged.
- It is due to the presence of sulphur bearing compound known as allyl-propyl-disulphide.
- There are 4 classes of colour of bulbs i.e. White, Yellow, Red and Brown.
- Red colour is due to anthocyanin pigment and yellow is due to quercetin pigment

NUTRITIVE VALUE (per 100 g of edible portion)

Particulars	Green	Bulb	Particulars	Green	Bulb
Moisture (%)	87.6	86.6	P (mg)	-	50
Protein (g)	0.9	1.2	Fe (mg)	7.5	0.7
Fat (g)	0.2	0.1	Vitamin-A (IU)	992	0
Carbohydrates(g)	8.9	11.1	Thiamine (mg)	0	0.08
Energy (kcal)	41	50	Riboflavin (mg)	0.01	0.01
Ca (mg)	50	47	Vitamin-C (mg)	17	11

AREA AND PRODUCTION

- The area under this crop in India was 1064 thousand ha having a production 15118 thousand tonnes with a productivity of 14.2 MT/ha (NHB, 2011).

CLIMATE

Role of temperature

- Onion does best under mild climate without extreme of heat and cold. It does not perform well in excessive rainfall.
- Before bulbing, temperature between 12.8-23oC is required whereas 20 to 25oC for at least 10 hours per day is required later for proper bulb development.
- About 70 per cent relative humidity is good for this crop.
- Very low temperatures in the beginning result in bolting while sudden rise in temperature favours early maturity of the crop resulting into small sized bulbs.
- Onion bulbs more quickly under warm temperature than at cool temperature.

- Temperature is more important in seed production than the day length. While photoperiod is more important than temperature for bulb formation.

Role of photoperiod

- Photoperiod requirement in onion is a quantitative character and each cultivar needs a minimum day length for bulb formation which is known as critical value.
- This critical value in combination with temperature influences bulb initiation.
- The so called short day cultivars when passed the critical value limit will initiate bulb formation and development is continued under long day conditions.
- Conversely, a long day cultivar will not be able to initiate bulb formation unless its longer critical value of photoperiod is reached.
- If onion plants are kept under short day conditions they continue to grow for over 3 years without bulbing.
- Short day cultivars form bulbs under long day conditions but long day can not form bulb under short day conditions.
- Almost all varieties grown in the plains are short-day cultivars.
- Kharif onion varieties require a day length of 10-11 hours where as rabi varieties require relatively higher temperature and 12-13 hours of day length.
- Brown Spanish is a long day variety (day length of more than 14 hours and a low temperature is required for proper development of bulbs).

SOIL

- Onion grows well on light loam, sandy loam or clay loam, deep friable and fertile soil rich in organic matter.
- The soil should be well drained.
- The optimum soil pH should be 5.8 to 6.5.

CULTIVARS

- The onion varieties have been classified on the basis of size and skin colour.
- Further, onion has been classified as common and multiplier onion.

A. Common Big Onion (Rabi):

1. Red Coloured: Agrifound Dark Red, Agrifound Light Red, Arka Niketan, Arka Pragati, Hisar-II, Kalyanpur Red Round, N-2-4-1, Punjab Red Round, Punjab Selection, Pusa Madhavi (Good Storage), Pusa Ratnar (Fair in storage), Pusa Red, Udaipur 101, Udaipur 103, VL-3

2. Kharif Onion: Arka Kalyan, Arka Pragati, Baswant-780, N-53, Arka Niketan (can also be grown in late kharif in Maharastra)

3. White skinned varieties: Pusa White Flat, Pusa White Round, N-257-9-1, Punjab-48, Udaipur-102

4. Yellow skinned varieties: Brown Spanish (Long day variety, suitable for growing in hills), Early Grano (Good for salad, suitable for green onions)

B. Multiplier Onion:

Agrifound Red, CO-1, CO-2 (resistant to purple blotch), CO-3 (resistant to thrips), CO-4 (moderately resistant to thrips), MDU-1

C. Small Onion:

Agrifound Rose (pickling type, suitable for export), Arka Bindu

Varietal characteristics of some of the important varieties are given as under:

RED SKINNED CULTIVARS

Agrifound Dark Red:

- Recommended for cultivation in summer season in hills and dry temperate zone of Himachal Pradesh.
- Bulbs are dark red, globular in shape with tight skin, moderately pungent.
- Matures in 100-110 days for maturity, excellent in keeping quality.
- Average yield 200-250q/ha.

Agrifound Light Red:

- Bulbs globular, 4-6 cm in size, matures in 160-165 days after sowing.

- Average yield is 300 q/ha.
- Recommended for winter (rabi) season and good for storage.

Agrifound Rose:

- A pickling type cultivar, bulbs 2.5-3.5 cm in size, matures in 95-110 days after sowing.
- Average yield is 190-200q/ha.
- Suitable for export.

Arka Bindu:

- Bulb size 2.5-3.5cm, mature in 100 days after transplanting.
- Average yield is 250q/ha in winter season and recommended for export

Arka Niketen:

- Bulbs globular, 4-6 cm across, mature in 145 days after transplanting.
- Average yield is 330q/ha.
- Good for storage and recommended for winter season (rabi).

Pusa Red:

- Bulbs medium sized, flat to globular, matures in 140-145 days after transplanting. Average yield is 250-300q/ha.
- Recommended for rabi season.
- Very good for storage.

Punjab Red Round:

- Medium to large sized bulbs, early maturing, yields on an average 300q/ha.
- Recommended for rabi season.

Punjab Selection:

- Bulbs of 5-5.5 cm in diameter, weighing about 50-70 g; average yield is 200q/ha.
- Recommended for rabi season.

WHITE SKINNED CULTIVARS

Pusa White Flat:

- Medium to large bulbs, TSS content is 12-14%, drying ratio is 9:1 matures in 20-130 days after sowing, average yield is 330-350q/ha.
- Recommended for rabi season.
- Suitable for dehydration purposes, very good for green onions and storage.

Pusa White Round:

- Matures in 125-130 days, TSS 12-13%, drying ratio is 8:1 and average yield is 300-330q/ha.
- Recommended for rabi season.
- Suitable for dehydration purposes and green onions.
- Very good in storage.

Punjab 48 (S-48):

- Average yield is 300q/ha, matures in 140 days after sowing.
- Suitable for dehydration purposes.

Udaipur 102:

- Bulbs 4.5-6.5 cm in size, mature in 120 days after transplanting, average yield is 300-350 q/ha.
- Suitable for rabi season and dehydration.

Palam Lohit:

- High yielding, attractive deep purple round
- Bulbs with narrow neck.
- Early in maturity than Patna Red
- Average bulb yield 450 q/ha.
- Moderately resistant to downy mildew.

YELLOW SKINNED VARIETIES

Brown Spanish:

- It is a medium long day type variety suitable for low hills.

- bulbs are thick skinned, bulbs are round and globular, brownish red coloured, less pungent, excellent storability, average yield 250-300q/ha

Early Grano:

- Bulbs 7-8 cm in size, mature in 95-110 days after transplanting, average yield is 500-600 q/ha.
- Good for salad.
- Suitable for green onions and better storage.

KHARIF ONION VARIETIES

Arka Kalyan:

- Bulbs 4-6 cm across, maturity 100-110DAT.
- Average yield 336 q/ha.
- Recommended for rainy (Kharif) season

Arka Pragati:

- Maturity 140-145 DAT.
- Recommended for winter (Rabi) and rainy (Kharif) season.
- Average yield 200 q/ha.

Baswant 780:

- Matures in 110-110 DAT.
- Average yield 200-250q/ha.
- Recommended for rainy (Kharif) season
- Good for storage.

N-53:

- Bulbs are globe shaped medium sized, very attractive, purplish red at harvesting and moderately pungent.
- Bulbs mature in 150-165 days, neck of the bulbs become thin at the time of maturity and leaves remain green.
- Most suitable for kharif season, average yield 150-180q/ha.

Arka Niketan:

- Bulbs globular, 4-6 cm across.
- Matures in145 DAT.
- Average yield 340 q/ha.
- Recommended for winter season. Good for storage

SOWING TIME

Season	Time of sowing	Time of transplanting	Harvesting time
Early rainy (kharif)	April-May	May-June	August
Rainy (kharif)	May-June	July-Aug	Oct-Nov
Winter (rabi)	(Sept-Oct)	Nov-Dec	March-April

SEED RATE

Propagation Method	Seed Rate/ha
Rabi	8-10 kg
Kharif	12-15 kg
Dibbling Method	20-25 kg

SPACING

- Follow a spacing of 15 cm between rows and 5-8cm between plant to plant
- Transplanting on ridges is ideal for kharif onion crop.
- Partial pruning of top is done in over-aged tall seedlings to augment the stand of the crop.
- It also provides convenience in planting.

SOIL PREPARATION AND TRANSPLANTING

- Onion should be planted in well-pulverized field by ploughing first with soil turning plough and afterwards with 4 to 5 ploughings with country plough.
- Leveling should follow ploughing.
- Onion is normally planted in flat beds however kharif onion is planted on ridges. Transplanting should be done during late afternoon

NUTRITIONAL REQUIREMENTS

- Apply well rottened Farm Yard Manure @200-300q, nitrogen @ 60-150kg, phosphorus@ 35-150 kg and Potassium@ 25-120kg per hectare depending on the soil test, cultivar and growing season.
- FYM is applied at the time of field preparation. Apply 50 per cent nitrogen and entire quantity of phosphorus and potash before transplanting or bulb sowing.
- Remaining half nitrogen is top dressed 5-6 weeks after transplanting.

IRRIGATION

- Just after transplanting and subsequently irrigation is given as per need of the crop and critical stages.
- Irrigation should be stopped 15-20 days before uprooting the bulb or before commencement of maturity.
- Onion needs very careful and frequent irrigation as it is a shallow rooted crop.
- Water requirement of the crop at the initial growth period is less and increases during later growth stages.
- Irrigation is to be applied at an interval of 10-15 days in cool weather and at a week interval during hot weather.
- Bulb formation and bulb enlargement stages (70-100 days after transplanting) are the critical for water requirement.
- Insufficient moisture tends to slow down bulb growth while over supply causes rotting. A dry spell may cause splitting of the outer scales.
- Generally, 10-12 irrigations are given in rabi season.
- Stop irrigation when the tops mature and start falling down.

INTER CULTURAL PRACTICES

- Onion is a closely planted and a shallow rooted crop and hence hand weeding is difficult which may damage the crop.
- Therefore, use of chemical weedicides at initial growth stage followed by 1-2 hand weeding is beneficial.
- The critical period of crop-weed competition is between 4-8 weeks.
- Apply Trifluralin @ 0.75-1.0 kg/ha or Alachlor (Lasso) @ 2 litres/ha or Pendimetalin (Stomp) @ 3 litres/ha as pre-transplant application in 750 litres of water.
- Soil incorporation of nitrofen @ 1.2-2.0 Kg/ha as post plant application is recommended at 25-30 days after transplanting.
- Three weedings are sufficient to harvest economic crop if performed at 30, 50 and 75 days after transplanting.

Growing kharif onions by sets:

- Onion sets are small bulbs (around 0.25-1.0 inch in diameter) grown in the previous year.
- These sets are used as the propagating material for the production of dry bulbs and bunching onions.
- Variety recommended for this crop is N-53.
- 5-7.5 kg seed is enough to raise sufficient number of sets to plant one hectare area.
- Sowing of seed is done during end of January or beginning of February (left plants at same place till April).
- In April, plants form small sets due to close spacing. The plants are uprooted and tops are removed.

- The sets having 1.5-2.0 cm diameter and disease free are selected and stored till July.
- About 10quintals sets are enough to plant one-hectare area.
- Sets are planted at 10cm apart in rows on both sides of ridges spaced 35-45 cm.
- Sets are normally planted by July-August to get an early crop by early November.
- These are commercially used to produce early green onions but also used for dry bulb production.

Production technology of rainy season (kharif) onion in northern India

- Onion is usually grown in winter (Rabi) season in Northern India, but it is grown both in Rabi and rainy season (Kharif) season in Central, Western and Northern India.
- Research work carried out in IARI has helped to standardize production technology to obtain successful Kharif crop.
- NHRDF has taken up this technology on large scale at farmer‟s fields in Rajasthan, Punjab, Haryana, Eastern Uttar Pradesh and Bihar.
- For successful Kharif crop, seed should be sown by end of May and June and transplanted in August.
- Harvesting is done in December-January. Suitable varieties for Kharif crop are N-53, Agrifound Dark Red, Baswant 780 and Arka Kalyan.
- About 150-200 q/ha of yield can be obtained.

Production technology of long day types in hills

- Use Brown Spanish variety.
- Seed sowing should be done in September-November.
- Transplanting should be done by March
- Harvesting should start in the month of August.
- Plants can be stored up to March-April

HARVESTING

- Onions are ready for dry bulbs harvesting when the tops get dried (or neck fall stage) and bulbs are mature.
- Harvesting at this stage results in higher yield, longer storage life of bulbs and less neck rot.
- The green onions can be harvested from the time they reach pencil size up until bulbing begins.
- To hasten the maturity process, the tops can be rolled down with a light weight roller when about 10 per cent of the tops have fallen naturally.
- It is desirable to leave 1.5-2.0 cm of the tops attached to the bulb as it helps to close neck and reduce storage loss.

Onion for green production

- Plants are pulled when bulbs just start formation

Immature bulb purpose

- As per need i.e. either for home consumption or supply to market, pull along with the tops.

Mature bulb purpose

- Picked when the top starts drooping just above the bulb point, it is also known as Neck-fall stage.

YIELD

Rabi Season:

- Average yield varies from 300-350 q/ha

Kharif Season:

- Average yield varies from 250-300 q/ha

DRYING AND CURING

- In northern India, for kharif season, curing is required for 2-3 weeks along with the tops.
- In rabi, bulbs are cured in field for 3-5 days in window method, tops are cut, leaving 2-2.5cm above the bulbs and then bulbs are again cured in shade for 7-10 days to remove the field heat.
- Curing for 10-12 days in shade helps in the development of more number of skin and also their retention for longer period.

CURING

Onion bulbs should be adequately cured because

- Curing or drying of bulbs is an important process to remove the excess moisture from the outer skin and neck of onion.
- This helps in reducing the infection of diseases and minimizes shrinkage due to removal of moisture from the interiors. This is, further, an additional measure for the development of skin colour.
- Bulbs are either cured in field or in open shades before storage.
- Onions are considered cured when neck is tight and the outer scales are dried until they rustle.
- Bulbs are cured in field for 3-5 days in wind row method.
- Then bulbs are placed in shade and cured for 7-10 days to remove field heat.
- This shade curing improves bulb colour and reduces losses during storage.

GRADING

- Onions are graded into big, medium and small size as per market demand.
- Thicknecked, bolted, doubles, injured and decayed bulbs are picked out and rest are graded into different size.

STORAGE

- At all temperatures, there is a gradual loss in weight of onion.
- The onion bulbs can be stored at temperatures of 23.9-29.4oC or higher for 5-6 months without sprouting and without excessive loss in weight.
- A temperature of 0oC and a relative humidity of 65-70 per cent has been recommended for successful storage

DISEASES

Fungal Diseases

Downy mildew: (*Peronospora destructor*)

- The first sign of the disease is the formation of elongated patches on leaves varying in size.
- These areas become covered with white to purplish fruiting bodies.
- Often, leaves fold over the affected area and the leaf tips wither away.
- Bulbs do not attain full growth and are often soft and immature.
- Cool temperature and presence of water is required for disease initiation.

Control measures

- Before sowing, treat the bulbs with mancozeb (0.25 %) followed by spray with the same fungicide at the same concentration.
- Regular sprays of metalaxyl + mancozeb (0.25%) checks this disease.

Onion smut : (*Urocystis cepulae*)

- This disease is more prevalent in temperate regions.
- The fungus survives in the soil.
- Dark brown streaks are seen on the leaves and stem.
- The bending and twisting of earlier infected leaves also occur.
- The linear black lesions most commonly appear near the base of the bulb and grow up to the fourth scale deep.

Control measures:

- Seed treatment with thiram or captan (3g/kg seed) checks seed borne infection.
- Also treat the soil with formaldehyde (1:7) before sowing.

Purple blotch : (*Alternaria porri*)

- It is very destructive under favourable conditions.
- The first spot usually appears on the oldest leaves.
- In the beginning they are small, elongated, sunken and whitish, generally with purple centre.
- These blotches later on enlarge, coalesce and are covered with the black fruiting bodies.

Control measures

- Seed treatments with captan or thiram (2.5g/kg seed), proper crop rotation, adequate drainage in the fields and fungicidal application of mancozeb (0.25%) have been found very effective.

Black mould: (*Aspergillus niger*)

- The infection starts from the top or any other injured portion.
- The affected tissue becomes water soaked and at first a white mould develops between the scales.
- This follows development of black spores on the stalk which can be seen with naked eyes and the mass remains on exterior of the scales and can easily be rubbed off.

Control measures

- Avoid bulb injury during various operations and sort out any bulb showing wound, green and thick neck, doubles etc.
- Allow only perfect bulbs for storage.
- Also clean the stores properly and check for sufficient ventilation, and temperature should be below 15oC.

Stemphylium leaf spot: (*Stemphylium vesicarium*)

- Purple coloured long spots appear on stems and leaves.

Control measures

- Spray of metalaxyl + mancozeb (0.25%) as soon as the symptoms appear.
- Repeat after 15-20 days if needed

Bacterial diseases

Soft rot: (*Erwinia carotovora pv. carotovora*)

- The disease is characterized by water soaked soft rot on inner scales of bulbs.
- Sometimes bulb appears healthy from outside but if cut open, 1-2 scales are found infected.

Control measures

- The disease can be managed by applying streptocycline (200 ppm), and the use of resistant varieties.

Viral disease

Onion yellow dwarf virus

- Short yellow streaks appear at the base of the first leaf emerging through the neck of the bulb.
- The leaves fall over and present an abnormal appearance.
- Flower stalks of the infected plant show yellow streaks extending upwards from the base.
- Later the streaks coalesce.
- The stalk becomes yellow throughout, and get twisted and curled in a characteristic manner.
- The leaves turn yellow, become crinkled and drop underdeveloped, although they are usually well shaped.

Control measures

- Indexing of virus free material, production of virus free stock of bulbs in areas where disease is absent and roguing out infected and volunteer onion plants will control the disease.

Pests

Onion thrips: (*Thrips tabaci*)

- Affected leaves show silvery white blotches which later become brownish.
- Spring summer crop is affected much by thrips.
- A long spell of dry weather is favourable for its rapid multiplication.

Control measures

- Collect the debris, affected leaves, weeds and destroy them.
- Follow crop rotation.
- Grow resistant varieties like Nasik Red and Spanish White.
- Apply malathion (0.05%) or phorate 10 G (1 kg /ha).

Borer: (*Helicoverpa armigera*)

- Larvae attack leaves, flower and flower stalks.

Control measures

- Collect and destroy affected flower and flower stalk and apply deltamethrin (0.0025 %).

Onion maggots: (*Hylemyia antiqua*)

- It attacks the tender portion of the bulb.
- They remain hiding in the base of the plants or in the cracks of the soil, where they also lay eggs.
- Affected plants become yellow to brown.

Control measures

- Soil application of phorate10G (25 kg/ha) and spray of malathion (0.05 %) can be done.
- Follow crop rotation.

Mites

- These are very small pests and remain mostly on the under surface of the leaves.
- Affected plants become pale yellow.
- Crop infested with mites gives sickly appearance.

Control measures

- Expose infected bulbs to sun for about two days and dust the crop with malathion dust (20-25 kg/ha).

Bulb or stem nematode: (*Ditylenchus dipsaci*)

- It is one of the important seed borne nematodes.
- Seedlings become pale white, twisted and stunted in growth.
- Leaves become thick and swell, resulting in splitting of the epidermis.
- Bulbs also carry nematodes.
- Tips of the leaves become necrotic.
- Cracks appear in the bulb.

Control measures

- Provide good drainage, obtain and use healthy seeds, follow long crop rotation and sow resistant varieties.

PHYSIOLOGICAL DISORDERS

Bolting

- It means emergence of seed stalk prior to time of bulb formation and adversely affects the formation and development of bulbs.

Possible Reasons

- Transplanting of aged seedlings
- Early sowing of seeds in the nursery beds, which result in the formation of small sets.
- Late transplanting of seedlings
- Restricted or poor vegetative growth also leads to bolting.

- Sharp fluctuations in temperatures at bulb initiation stage.
- Low temperature (10-12oC) for prolonged period.
- Poor supply of nitrogen in nursery and field.

Correction

- Time of planting should be adjusted in such a way that the crop may expose to moderate temperature at bulbing.
- Sowing of nursery at proper time
- Transplant healthy and 6-7 weeks old seedlings.
- Supply recommended dose of nitrogen.

Sprouting

- An important disorder in storage of onion and garlic and results in huge losses.
- It is associated with excessive moisture at maturity and supply of nitrogen.

Correction:

- Adjust time of planting in such a way that harvesting can be done in dry period.
- Stop irrigation as soon as bulbs reach maturity.
- Spray iron sulphate or borax @ 500-1000 ppm 2-3 weeks prior to harvesting.