



Hort.2204

**Production Technology of
Vegetable Crops (2+1)**

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Lecture-1

Vegetable production

- Largest producer - China
- **2nd largest – India**

In India

- Annual production - 184.39 million metric tonnes
- Area – 10.25 million ha

- India is the **largest producer of okra (73% of world prdn)** amongst vegetables
- Ranks **second** in production of **potatoes, tomato, onions, cauliflowers, brinjal, Cabbages, brassicas .**

- India contributes to 15% of total world pdn of vegetables from 3% of total area (only 1.5% export share)
- Potato > tomato > onion > cabbage > cauliflower accounts total of 60% of vegetable pdn in the country
- In India vegetables are grown in the open field
- India Ist in the pdn of potato, II in onion

West Bengal is the **largest producer** of fresh Vegetables in India, followed by Uttar Pradesh, Bihar and Madhya Pradesh.

Major vegetables grown in India are Potato, Onion, Tomato, Cauliflower, Cabbage, Bean, Egg Plants, Cucumber and Gherkin, Frozen Peas, Garlic and okra.

Export

- Major exported vegetables are-
onion, okra, bitter gourd, green chilli,
mushroom and potato
- Major exporting countries –
- UAE, Sri Lanka, Netherland, Bangladesh,
Saudi Arabia and Qatar

- Global production of vegetables:
Potato>tomato>onion>cabbage>brinjal
- Vegetable crops occupies 2.8% of total cultivated area in India
- Owing to diverse climatic conditions prevailing in different parts of the country ,large variety of vegetable crops ranging from tropical to temperate vegetables can be produced

- Higher productivity due to - adoption of HYV, F1 hybrids, suitable pdn technologies
- Per capita consumption 175 g/day
- More than 40 kinds of vegetables grown in different agro climatic regions of the country
- Except a few vegetables like brinjal ,colocasia, cucumber, ridge gourd ,sponge gourd ,pointed gourd most of the other vegetables are introduced from abroad

- It is edible herbaceous plant parts ,consumed raw or after cooking ;rich in vitamins and minerals, low in calorific value ,neutralises acid produced during digestion of high energy food
- Vegetables include large number of plants ,mostly annuals ,some perennials grown for their edible leaves ,stem, flower bud ,flowers, fruits and roots
- Vegetables are part of balanced diet and considered as **protective food** with a prominent role in combating malnutrition

Olericulture

It is a branch of horticulture that deals with production, storage , processing and marketing of vegetables

Latin word

- **Holeris=any kind of pot herb**
- **cultura=cultivate**

- Vegetable is a **culinary term**
- Vegetable : All part of herbaceous plants eaten as food by human ,whole or in part
- The term vegetable is **not a botanical term**. Therefore no contradiction in referring to a plant part as fruit while also being considered as vegetable .
- Given this general rule vegetables includes:
leaves(lettuce),stems(asparagus),roots(carrot),Flowers(broccoli),bulb(garlic, onion),seeds(peas & beans) & fruits(cucumber, squash, pumpkin ,capsicums)

Nutritive value of vegetables

- Vitamins=water soluble(B,C); fat soluble(A,D)
- Minerals
- Fibre
- Carbohydrates
- Protein(pulses)
- Anti oxidants, anti fungal, anti viral, anti carcinogenic compounds.
- Green colour=chlorophyll,
yellow/orange=carotenoides
- red/blue colour =anthocyanin

Importance of vegetables

- Vegetables are rich and cheaper sources of vitamins like beta carotene, vitamin B,C,E,folic acid minerals like Ca, Fe, Mg, P, and dietary fibres
- Vegetables also supplies fair amount of carbohydrate, proteins(4%) and energy(10%)
- They are **protective food** as their consumption prevents many diseases
- Chemicals like **antioxidants** and **flavonoids** which are having therapeutic value are present in vegetables
- Beta carotene, ascorbic acid, alpha tocopherol, amino acids and flavinoids acts as **free radical scavengers**

Vitamin A

- Deficiency leads to night blindness and dry eyes (**Xerophthalmia**)
- Vitamin A is obtained from food in the form of **retinol** (a preformed vitamin A) and as **Beta carotene** or provitamin A which gets converted to vitamin A in the liver and intestine.
- **Beta carotene** found in the **green leaf vegetables** and yellow fruits(pumpkin,) tubers like carrot sweet potato
- This fat soluble vitamin is not soluble in water and not lost while cutting ,washing, cooking

Vitamin B complex

- Deficiency of Thiamine (B1) leads to *beri-beri* disease. Vitamin B complex consisting riboflavin, nicotinic acid,(niacin),vit.B6 (pyridoxine) ,Vit. B12 and folic acid are essential for metabolic activities and their deficiency leads to *pellagra*, anaemia
- Leguminous vegetables, onion bulb, green onion ,sweet potato and cabbage contains Vitamins B groups
- Folic acid abundant in spinach, bean other green leafy vegetables

VitaminC (ascorbic acid)

- Man require 50mg of vitamin C daily
- Deficiency causes **scurvy** characterised by weakness, bleeding gums and defective bone growth
- Vitamin C is a strong reducing agent easily lost on exposure to air and on cooking
- Vegetables like **tomato, sweet pepper, chilli, immature bean seeds, bean sprouts** are rich source

Vitamin E(alpha tocopherol)

- Prevents oxidation of beta carotene in intestine
- Green leafy vegetables are good source of this vitamin

Minerals

- Leaf vegetables like palak, fenugreek, drumstick supply minerals like Ca, Fe, P,Mg
- Tender **fruits of okra** contains **Iodine**, essential for prevention of goitre

Carbohydrates

- Roots and tuber vegetables like potato, sweet potato, cassava, yams, elephant foot yams contains high amount of potato

Proteins

- Leguminous vegetables like peas, beans, cowpea and hyacinth bean are good sources of Protein (14%)

Dietary fibre

- cellulose, non starch polysaccharides, lignin.
Most of the leafy vegetables are rich source of dietary fibre
- Recommended daily allowance of vegetables (RDA) by the ICMR for adult is **300 g** of vegetables ,which includes **115 of leafy and other vegetables** and **70g of root vegetables**.

Advantages of vegetables

- 5-10 times more yield/unit area
- shorter duration –returns in 3-4 months, fitted efficiently in **any cropping system**
- labour intensive –generates additional **farm employment**
- Fresh vegetables, processed products, vegetable seeds are exported to foreign countries.
- potato>gherkin>okra>bittergourd>chilli>onion>cauliflower>root vegetables >cowpea.

Source of special compounds

- **Onion and garlic** contains sulphur compounds like **allicin** and **diallyl disulphide** which are effective for controlling blood cholesterol and heart diseases. It has anti bacterial properties
- **Diphenyl amine** in onion is effective against **diabetes**
- Bitter gourd contains a hypoglycaemic compound called **charantin**
- Yams contains **diosgenin** used in the manufacture of steroids
- Cole crops contains anti carcinogenic compounds like **glucosinolates**.

Toxic anti nutrient compounds

Trypsin inhibitors

- Widely distributed in legumes especially in raw soybean
- They **inhibit the activity of trypsin** in the gut and interfere with digestibility and reduce their utilization by affecting hydrolysis of protein into amino acids
- **Phytic acid** present in the mature seeds of peas and beans binds with Fe, Zn, Ca, Mg and **reduces their availability of Fe**. On germination phytic acid content reduces due to enzymatic break down

Oxalates

- Green leaf vegetables and legumes are rich in oxalic acid
- Oxalic makes Ca from consumed food into **insoluble oxalates** making it unavailable for absorption

Nitrates

- single largest source of nitrates in the human diet
- Leafy vegetables have high concentration of nitrates
- Within the gastro intestinal tract **nitrates get converted into nitrites** –absorbed into the blood stream-binds with the haemoglobin –**oxidising ferrous iron to ferric iron** to form methheamoglobin
- Methheamoglobin incapable of O₂ transport and results in anaemia called methaemoglobanaemia
- Upon cooking nitrate content reduces drastically

Glucosides

- **Tapioca** leaves contains glucosides which liberates HCN in stomach
- Dioscorea contain toxic alkaloid called **Dioscorin** which could be made harmless by boiling
- **Potato** tubers when exposed to sun become green and produce one alkaloid called **solanine** which is bitter in taste
- Few brinjal varieties also contain solanine

Glucosinolates(Thioglucosides)

- These are sulphur containing compounds thioglucosides (sinigrin) are non- goitrogenic
- But on enzymatic hydrolysis by the enzyme **myrosinase** it produces **allyl thiocynate** –a goitrogen
- High intake of cole crops causes enlargement of thyroid glands

Vegetable Research

- Plant introduction scheme by ICAR, New Delhi
- Introduced number of vegetable crops and developed improved varieties
- Vegetable breeding station at Kullu valley Katrain research on temperate vegetables started
- Separate Department of Horticulture at IIHR, B'lore and IARI gave momentum for vegetable breeding
- Establishment of state agricultural university from 1960 onwards gave boost to vegetable research
- Creation of separate department of Horticulture ,later separate department of olericulture in SAU strengthened vegetable research
- All India Coordinated vegetable research project (AICVIP) in 1970-71 in 4th five year plan ,it was possible to test varieties at national level

- Project Directorate of vegetable research (PDVR) was started in in 1978 during 7 th five year plan at IARI. Now the head quarters of PDVR was shifted to Varanasi
- PDVR later elevated as Indian Institute of vegetable research(IIVR)
- NBPGR =collection and evaluation and conservation of vegetable germplasm
- NRC on onion and garlic at Nasik, Pune is a mile stone in history of onion and research
- Private seed companies Like Indo-American hybrid seed company ,B'lore,
- Maharashtra hybrid seed company at Jalna , (MH)
- Nath seeds (Aurangabad) Ankur seeds Delhi, played important role in development of F1 hybrdis

International research organizations like

- Asian vegetable research and development centre (AVRDC, Taiwan)
- International Institute of Tropical Agriculture, (IITA) Ibadan ,Nigeria
- Department of vegetable science , University of California,(Davis)
- International Service for National Agricultural Research Hague (The Netherlands)
- International potato Research Centre (Peru)
- Vegetable laboratory (USDA,Bestville)
- Horticulture research Institute ,Melbourne, Australia are the international institutes