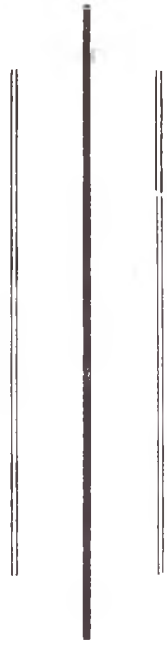
PROCEEDINGS OF REGIONAL SEMINAR

ON

VEGETABLE CROPS OF BIHAR



Organized by :

KRISHNA CHANDRA MISHRA RESEARCH INSTITUTE OF WILD VEGATABLE CROPS

BANDANWAR-814 147 GODDA (BIHAR)

19th. MARCH, 1989

INDEX

PREFACE

A seminar on wild vegetable crops of Bihar was held on March 19,1989 at University Department of Botany, Bhagalpur University,Bhagalpur. The seminar was organized by Krishna Chandra Mishra Research Institute of Wild Vegetable Crops,Bandanwar ,Godda and was sponsored by the National Horticulture Board and DRDA, Bhagalpur. About 100 participants attended the deliberations and a large number of papers were presented on the different aspects of vegetable crops. Sri Arun Jha,IAS,District Magistrate Bhagalpur inaugurated the seminar and Prof K.S.Bilgrami,Head,Department of Botany,Bhagalpur University presided over the function.

The present proceedings give a glimpse of vegetable crop resources of Bihar,domestication of wild vegetables,management of hill and forest soil for vegetable crops, post harvest technology, reproductive biology and improvement of vegetable crops through tissue culture techniques.

We are thankful to Mr. O.P.Grover,Project Manager, National Horticulture Board, Govt. of India,Mr.Arun Jha Chairman cum District Magistrate,DRDA,Bhagalpur and Dr. S.P.Singh Hon. Secretary K.C.Mishra Research Institute for providing financial assistance. Thanks are due to Prof K.S.Bilgrami,for providing venue for the seminar and Prof G.M.Mishra and other faculty members of the Department of Horticulture (Vegetable and Floriculture),Bihar College of Agriculture,Sabour for actively participating in the seminar. We are sure that this volume will be helpful in formulation of developmental schemes for vegetable crop production in Bihar.

Editors.

PRESIDENTIAL REMARKS

K.S.BILGRAMI
University Department of Botany
Bhagalpur University,Bhagalpur

Vegetables have been in use since time immemorial. The earliest man started searching for natural resources to live on. Survival being the very purpose of the human being, all possible natural products from the surroundings were collected. Some of these were useless and hence only those found to be tasty and useful were ultimately retained after thorough screening. It is said that this screening used to be done by primitive women because men were generally busy in hunting.

Today with stupendous increase in population, there is greater need for production of vitaminous food. Besides known cultivated vegetables,there are a large number of wild plants which are very nutritive and can be exploited for edible purposes. Some of the wild vegetables are **kakrol,ban kunri,kunri,ole** etc. **Kakrol** is most nutritive of all fruit vegetables and fetch high price in the market which indicates the preferences of consumers. Another important wild vegetable crop is **bankunri**,the fruits of which are very rich in calcium. Because of this,it may be included in the diet of children and nursing mothers. **Dioscorea** tubers are rich source of vitamins. This plant grows in wild conditions,and is mostly consumed by tribals. As this plant grows well in poor rocky soils,its large scale cultivation on hill slops and wastelands is comparatively easier.

Bihar state is rich in tribal population and division of Santhal Parganas and Chotanagpur are predominated by tribals. Besides using common cultivated vegetables, tribals supplement their food requirement from wild vegetables. As wild vegetables play important role in the tribal life while planning development schemes for tribals,commercial cultivation of wild vegetables deserve special attention. The planned cropping of the wild vegetables will greatly help in uplifting socio-economic condition of the tribals. This would provide them an opportunity for better employment and also bring the marginal and wasteland under cultivation.

Wild vegetables are not only

nutritious but they are medicinally important. These vegetables are ideal for patients of diabetes,gout and those suffering with nutritional deficiencies. The production of vegetable crops in Bihar is inadequate which may be increased by covering more area under vegetable cultivation and also by domesticating wild vegetable crops. Despite vast and varied flora in Bihar, no planned efforts have so far been made to grow wild vegetables on commercial scale and channelise the energy of tribal people for collection and cultivation of wild vegetables.

Due to non availability of methodology for mass scale propagation of wild vegetable crops, it has been possible to domesticate them for large scale consumption. There is thus urgent need to establish pilot nurseries for production of seeds,tubers, cuttings and saplings of wild edibles. K.C.Mishra Research Institute of Wild Vegetable Crops at Godda has initiated work on germplasm collection,their propagation and large scale cultivation with a view to provide planting materials to the tribals. I hope that the deliberations of the seminar would provide a basis for domestication and improvement and mass scale propagation of wild vegetable crops.

INAUGURAL LECTURE

ARUN JHA, I.A.S.

District Magistrate, Cum Chairman D.R.D.A., Bhagalpur

All of us take vegetables in our daily diet but vegetables are not accorded the importance they deserve. The main reason for this situation is ignorance of the nutritive value of vegetables and the cost and difficulties of storage and distribution. In many families vegetables are not considered as food. At best they are prepared and accepted as a relish or flavouring agent. Consequently they are seldom included in children's diet. Even adults consume such small quantities of vegetables that it is obvious that the nutritional aspects of these foods are hardly recognised.

The daily minimum requirement of vegetables is 284 g per head, i.e. about 20 per cent of daily requirement of the total food of an adult: of this 114 g should be green leafy vegetables. Vegetarian diet requires more vegetables. It is desirable to include many different forms of vegetables in our diet than taking a limited number every day.

The vegetable production in our country is 35.84 million tonnes spread over an area of 4.24 million ha. This, however,

provides only 130 g per head per day i.e. about only half of the requirement. In Bihar, vegetables are grown on 0.78 million ha.

In Bihar only 6.37% of food budget is spent over vegetables the cereals occuping 62.85% which is about 10 times more than the vegetables. In hilly regions of Bihar tribals consume various forms of leaves and average daily consumption is very low. Consumption of other vegetables is low in South Bihar. Thus consumption of vegetables in different parts of Bihar is not balanced. There is deficiencies of protein, calcium, vitamin A, riboflavin and vitamin C in the diet of people of Bihar. Shall we allow our people to die slowly or can we do something to allivate their sufferings ?

We have to produce more vegetables and consume vegetables of desired types. Sweet pepper (103 mg vit. C/100 g), 'kheksa' (275 mg/100 g), bitter gourd (57 mg/100g) and dark green leaves should be consumed to meet requirement of vit. C. Carrot and leafy vegetables are good source of vit. A. Unfortunately carrot is not considered to be a good item of food in many villages. For calcium, green leafy vegetables, okra and 'bankunri (Solena amplexicaulis) should be consumed. The daily requirement of riboflavin is about 1.5 mg. Mushrooms are good source of riboflavin (0.42 mg/100 g) and niacin (4.8 mg/100g).

In Bihar there is poverty in land of prosperity. Bihar has abundant horticultural wealth, most fertile soil and sufficient man power. Many vegetable crops are indigenous to Bihar. The forests of Santhal Pargana and Chotanagpur divisions and also of South Bhagalpur and Munger districts are full of edible vegetables. Their nutritive value is very high, keeping and transport qualities are good and they can be grown in dry land condition with minimum or no input of fertilizers and insecticides. Why not conserve and popularise these vegetables than go for vegetables of exotic origin that are less adapted to our environmental conditions.

Vegetable production can be achieved by increasing both the present area under vegetable cultivation and yield per unit area. Losses due to insects and diseases should be minimised by breeding resistant varieties and by applying insecticides which are least harmful to man and animal. If losses after harvest, which is nearly 25% of the total produce could be checked it will automatically increase the total available vegetables for consumption.

Storage and transport facilities and good connecting roads to vegetable growing areas will encourage farmers to grow more vegetables.

Processing of vegetables is very important. Only 1 per cent of vegetables are exported where as about 25-30 per cent

are lost either during transport or due to lack of proper transportation. At times the farmers are forced to sale their produce at throwaway prices.

For increasing vegetable production we require quality seeds. It is also required to minimise losses of seeds. A thrust is required to tissue culture for quick propagation and production of virus free plants.

Priority should be given to collection and screening of germplasm for selection and breeding of cultivars with better productivity, quality characteristics, resistant to drought pest and disease, tolerance to salinity and alkalinity and for different stress environment. Fast eroding gene pool should be conserved and utilized.

Let Bihar lead in vegetable production. Government, Research Institutions, voluntary organization co-operatives, DRDA and financing agencies should co-operate with the farmers to increase vegetable production, to develope cheaper system of transportation and distribution and storage to ensure a constant supply of vegetables at resonable price the year round.

With these words I formally inaugurate the seminar on Vegetable Crops of Bihar organized by Krishna Chandra Mishra Research Institute of Wild Vegetable Crops.

KRISHNA CHANDRA MISHRA RESEARCH INSTITUTE OF WILD VEGETABLE CROPS BANDANWAR

Krishna Chandra Mishra Research Institute of Wild Vegetable Crops is located in village Bandanwar in Godda district of Bihar. It is 13 km from Godda headquarters. An experimental station of the Institute is located in Samukhia village of Bhagalpur District. It is 12 km from Banka Block headquarters.

The Institute was started in 1978 by late Krishna Chandra Mishra with his personal financial resources. He was an eminent educationist and social worker of village Bandanwar and was one who realised the importance of indigenous and wild vegetable crops for the socio-economic development of tribals of this area. The Institute was registered (its registration number being 139/85-86) in 1985 under the Societies Registration Act 1860. It is a rural based non-profit making scientific voluntary organization. It is governed by an executive committee of nine members and office bearers.

OBJECTIVES :

The main objectives of the Institute are:-

1. Survey and collection of wild and cultivated vegetable crops.
2. Conservation and multiplication of germplasm in the experimental field of the Institute.
3. Development of improved techniques for the cultivation of vegetable crops.
4. Improvement of vegetable crops through breeding.
5. Screening of vegetable plants for their nutritional and medicinal properties.
6. Exchange of germplasm with other institutions and progressive farmers.
7. Demonstration and training of improved cultivation techniques, plant protection and vegetable preservation with an eyes to special benefits to women and members of Schedule Caste and Schedule Tribe.

MEMBERSHIP :

Any person who is interested in the above mentioned objectives or activities related to vegetable growing can become a member of the organization by submitting an application. Members will be enrolled with the approval of the Executive Committee. At present the admission fee is Rs.100 and monthly membership fee is Rs.2/-. Life membership

fee is Rs.300/-. At present there are 10 ordinary members and 9 life members of the Institute. The Institute supplies 6 seeds/planting material of each germplasm free of cost to each member. Members are also expected to collect germplasm for the Institute.

ACTIVITIES OF THE INSTITUTE :

From the beginning the Institute is actively engaged in collecting the germplasm of vegetables from different parts of the state of Bihar and also from different parts of India. The Institute took several region specific and crop specific explorations.

COLLECTION OF GERMPLASM :

The exploration activities of the Institute started in 1978-79 when a few specimens of wild vegetables were collected from Chandan block (Bhagalpur) and Pirtand (Giridih) of Bihar chiefly for agronomical studies. Local collection of 'Kundri' (*Coccinia grandis*), Poi (*Basella alba*), 'Barbatti' (*Vigna unguiculata*), 'Sem' (*Dolichos lablab*), 'Karela' (*Momordica charantia*), 'Khamarua (*Dioscorea* spp.), 'Ol' (*Amorphophallus paeonifolius*), 'Parol' (*Luffa cylindrica*) was made during the year.

In 1980 a staminate plant of Kheksa (*Momordica dioica*, diploid) was introduced from Sambhupati village of Samastipur.

In 1981 a few seeds of Momordica cochinchinensis were supplied by Mr. R.P. Sahu an active member of our Institute.

In 1982 a single female plant of Momordica dioica (tetraploid 4n=56) was collected from Nadia district of West Bengal. Germplasm of 'Parwal' (Tricosanthes dioica Roxb.) and 'Lal poi' (Basella rubra) were also collected during the year.

In 1983 seeds of 'mitha karela' (Momordica balsamina) were introduced from a West German seed bank. In the same year exploration was organized in Rajmahal hills and many specimens of 'Kheksa' (M. dioica), 'bankundri' (Solena amplexicaulis), 'Kunri' (Coccinia grandis) 'Sahjna' (Moringa oleifera were collected. Germplasms of Parwal (Trichosanthes dioica) were collected from Samastipur and Cucumis melo var Ghurmi from Lohardaga district of Bihar, clove bean (Ipomoea muricata) were introduced from Kerala. In the same year, extensive search was made in Assam for Hathi karela (Momordica cochinchinensis) when our team could collect only three tubers of female. Bhat Karela (Momordica dioica, tetraploid) tubers were also collected during the exploration.

The exploration and other activities of the Institute received a set back after the sad demise of Krishna Chandra Mishra on 31st October, 1984.

In 1985, in a general meeting of the villagers of Bandanwar, it was decided that the activities of germplasm collection and plant introduction should continue for the benefit of the farmers. The Institute was previously known as Krishna Chandra Mishra Agriculture Research Institute but its name was changed to Krishna Chandra Misra Research Institute of Wild Vegetable Crops, it was then registered. Dr. U.C. Jha was nominated as Director and Kishore Chandra Mishra as Honorary Secretary.

In 1985 extensive and systematic collections were made in Meghalaya and Assam by the Institute. Germplasms of 'Parol' (Luffa cylindrica), 'Hathi Karela' (Momordica cochinchinensis) and 'Bhat karela' (Momordica dioica) were collected during the expedition.

In 1986 the Institute collected germplasms of 'Pedar' (Xeromphis uliginosa) 'Parwal' (Trichosanthes dioica), 'Kheksa (Momordica dioica), Acacia senegal, winged bean (Psophocarpus tetragonolobus), and 'Bankundri' (Solena amplexicaulis).

In 1987 germplasms of 'Kumbhatia' (Acacia senegal) 'Khejri' (Prosopis cinenraria) and 'sahjan' (Moringa oleifera) were collected with the assistance of Central Arid Zone Research Institute (CAZRI), Jodhpur. In the same year germplasms of Kasturi (Abelmoschus moschatus), Kareli (Momordica charantia) and bamboo were collected.

In 1988, we collected germplasms of parwal from Samastipur and Bhagalpur district. This Institute plans to collect germplasms of vegetables from South India during the year 1989-90.

ACCLIMATISATION :

In addition to our direct exploration for vegetable germplasm collection, which is a difficult job, we are also collecting germplasm of vegetables through contacts and correspondence. We have collected Momordica cochinchinensis from Japan, Momordica balsamina from West Germany, a dwarf mutant winged bean (Psophocarpus tetragonolobus) from Bangalore, egg plant (Solanum melongena) from Denmark and Karnatak, a YVM tolerent Okra from Sabour.

Our acclimatisation trials have shown that M. cochinchinensis, M. balasamina, Ipomoea muricata, Trichosanthes dioica and T. anguina could be cultivated in Godda. Bamboo shoots are delicious vegetable and pickles can be prepared from them, and if properly and hygienically canned can be exported and thereby foreign exchange earned.

Our attempts to domesticate Cyclenthera pedata, Sechium edule (Meghalaya), Acacia senegal, Prosopis cineraria (Jodhpur) are still continuing.

EVALUATION :

We have collected about 250 germplasms of about 25 species of vegetable crops of which about 10 species are wild. We are in touch with International Board of Plant Genetic Resources (IBPGR) and a list of our collections will soon be published by IBPGR in its current edition of Directory of Germplasm collection (Vegetable).

The collected materials were evaluated at the Institute as well as in other institutions of the country. We have published popular articles on M. dioica, M. balasamina, M. cochinchinensis based on our experience. Articles were appreciated by scientists as well as by amateur vegetable growers. We are regularly receiving letters asking for germplasms of different vegetables from various universities and institutions.

Mitotic studies of M. chochinchinensis was made 1986 by Dr. S.P. Sinha of Department of Zoology, Bhagalpur University. Seeds of M. cochinchinensis were also given to Dr. A.K. Pandey of University Department of Botany, Bhagalpur University for embryological studies. Floral biology of M. dioica (diploid) was studied by Mishra and Pandey (unpublished). Dr. K.V. Peter and Mr. Abdul Vahab of Kerala Agriculture University utilized our material for study of generic relationship of different Momordica spp.

(1984) Jha and Roy and Jha and Trivedi have studied in detail cytology and pollination mechanism of Momordica balsamina from materials given from the Institute.

There is a great demand of our collections from various Institutions and we have been able to supply germplasm to only limited institutions. We have supplied germplasms of M. dioica (tetraploid) to National Bureau of Plant Genetic Resources, New Delhi, Dr. A.K. Shrivastava, Dean Basic Sciences, RAU, Pusa and Dr. Baikuntha Mishra, Department of Pathology, Tirhut College of Agriculture, Dholi. We have not been able to fulfil the demands of germplasm of Gujarat Agricultural University, Chandra Shekhar Azad University, Kanpur, Andhra Agricultural University for M. dioica, to NBPGR Trichur for M. chochinchinensis and many farmers for want of funds. The demand from farmers is very high and here also we could supply planting materials to limited persons only. Thus our collected germplasms were put to active use and are in constant demand.

We have also evaluated vegetable germplasms of other Institutions for adaptation such as a YVM tolerent Okra variety screened by RAU, Sabour was also found tolerant in our trials. We have evaluated M. chochinchinensis of Takeda Yakuhin Kogy Co. Ltd. Japan, M. balsamina of AKADEMIC DER WISENSCRAFTE DER DDR, a dwarf mutant winged bean of University of Agricultural Science Banglore.

People try to grow only female tubers of Momordica dioica and do not get fruits in their kitchen garden. We found that at least 10 percent male plants must be grown close to female plants for pollination. Hand pollination was found to increase the yield by 80 per cent. Mishra and Pandey (unpublished) found that the anthesis in M. dioica (2n=28) takes place in night and the pollen remains viable and stigma receptive 11 hours before anthesis to 13 hours after anthesis. The anthesis in M. dioica (tetraploid) takes place during morning hours. Honey bees are, therefore, suitable pollinators only for the tetraploid form.

We have introduced M. dioica (tetraploid) from Nadia district of West Bengal. It is an early, vigorously growing variety with bigger fruits and is suitable for commercial cultivation. We are in a position to guide large scale cultivation of this crop. This year we are planning to take up large scale cultivation in Desai Agriculture Farm, Puna and also in farmers field at Samukhia and Santhal Pargana. We are also planning to supply planting materials on a large scale to a South Indian seed distributor.

M. dioica was considered to be strictly dioecious by Roy et al. However we have noticed hermaphrodite flowers in old plantation of tetraploid female plants at the Institute. We have also observed sex reversal in M. dioica and Coccinia grandis. (Mishra, K.C. & Srivastav, A.K. unpublished).

M. cochinchinensis is another vegetable plant that has been established by us with difficulty. Three tubers of female were collected in 1983 and we had to remain satisfied with parthenocarpic fruits obtained using 2,4,5.T.

Our limited effort on germplasm collection and its domestications are highly rewarding. Our observations have revealed that M. dioica (tetraploid) was wrongly indentified to be M. chochinchinensis by many authors We found that M. dioica (tetraploid) and M. chochinchinensis are distinct species and the crosses between M. dioica and M. chochinchinensis failed in all cases.

We have further observed that M. dioica (2n=28) M. dioica (4n=56), M. chochinchinensis, M. charantia, Luffa cylindrica, Luffa acutangula, Coccinia grandis, Solena amplexicaulis, Trichosanthes dioica can be vegetatively multiplied using single node stem cutting and using root promoting plant hormones. It proved to be a boon for large scale cultivation of dioecious parennial crops as large scale planting material of either sex can be easily multiplied.

Insects on wild vegetable crops under cultivation were also studied. Incidence of Dacus maculata fruit fly on M. dioica is our first report. We have also found an appentalis species on Margorina indica which has been sent to Kew for proper identification.

In our attempt to select vegetables of high nutritional value we have found that 'Kakrol' (M. dioica) is most nutritive of all fruit vegetables. Its average nutritional value according to Rinho's formula is 14 whereas that of 'Parwal (Trichosanthes dioica) is only 5. It also gives high price in the market indicating consumers preference. This vegetable is, therefore of great socio-economic importance. The dioecious nature of the plant is a very important factor. In 1985 seeds of M. chochinchinensis were collected from Assam. We have now male plants from these seeds and we get fruits of this vegetable in our experimental garden. 2,4,5-T was also found to produce parthenocarpic fruit in M. dioica (diploid and tetraploid) and M. chochinchinensis. We have also counted somatic chromosome number for M. chochinchinensis to be 28.

Solena amplexicuiis is another important wild vegetable crop in our collection. It is very rich in calcium and should, therefore be included in the diet of children and nursing mother. It is a less known vegetable crop. The collection from forest is not enough and most of it is consumed by the tribals themselves. It gives fruits twice a year, once in May and again the October.

Momordica balsamina is non-bitter in taste. Plant resembles bitter gourd but fruit are very small in comparison to the bitter gourd.

Winged bean and Dwarf Mutant Winged been introduced from Bangalore gave satisfactory yield, but local consumers shall have to adapt themselves to its taste.

Dioscorea spp gave satisfactory yield in poor rocky soils and are choice of local consumer and so also Ole (Amorphophallus paeonifolius).

Coccinia grandis gives high yield in most part of the year (except Dec. - Feb.). Previously tribal people had to use long thick stem as planting material. Now we use and supply rooted cuttings with the help of root promoting hormones.

MAINTENANCE :

Institute evaluates and maintains the germplasms of wild/cultivated vegetable crops. Maintenance is a real difficult part of our activities as most of the collections are cross pollinated. We vegetatively multiply all the available diversity of our collections and distribute them to others. We thus conserve diversity by multiplication and cultivation. Since we do not have modern facilities of keeping seeds at low temperature, we have lost many valuable collections. It is proposed to duplicate our collections at Samukhia and also in the University Department of Botany, Bhagalpur University. A number of Institutions and individuals have requested for samples from our collections. We are supplying desired materials to them.

ASSOCIATION AND ASSISTANCE :

During our development and progress we have received tremendous assistance from scientists and various organizations. Prof. Bilgrami has provided facility to work in department for which we are indebted.

In 1988 a VITA volunteer Mr. Matthew G. Boissevain co-operated with us in conducting a workshop on irrigational devices for kitchen garden and we have developed a low cost bicycle cup rope pump and a bicycle wind pump. Bihar Renewable Energy Development Agency has provided us a Solar water pump at subsidised rate. National Horticulture Board has given financial assistance for publication of the proceedings of this seminar and for display of materials etc and also for publication of a mannual of cultivation technique in Hindi. Department of Science and Technology has sanctioned a project entitled "Experimental cultivation of Wild vegetable crops for the Socio-economic Development of Tribals of Santhal Pargana." District Rural Development Agency, Bhagalpur has also assisted us in conducting this Seminar on Vegetable crops of Bihar.

WILD VEGETABLE RESOURCES OF SANTHAL PARGANA

K.K. SINGH and S.K. VARMA

University Department of Botany,
Bhagalpur University, Bhagalpur - 812007

ABSTRACT

The paper enumerates the wild vegetable resources of Santhal Pargana. In all 62 vascular plant species have been recorded. Of these 4 species belong to pteridophytes and 58 to angiosperms. Among the vegetables collected from the wild, 10 constitute roots, or underground portions, 26 constitute tender shoots and leaves, 5 flowers and inflorescence and the rest constitute fruits and seeds. Some common wild vegetables widely consumed by the tribals of Santhal Pargana are viz.. *Abelmoschus crinitus* Wall., *Amaranathus spinosus* L., *Antidesma diandrum* (Roxb) Roth, *Bauhinia purpurea* L., *Bombax ceiba* L., *Cassia fistula* L., *C. tora* L., *Catunaregum uliginosa* (Retz.) Shivrajan, *Ceratopteris thalictroides* Brong, *Cleome monophylla* L., *Celosia argentea* L., *Commelina benghalensis* L., *Dioscorea glabra* Roxb., *Enydra fluctuans* Lour., *Ficus hispida* L.f., *Ficus racemosa* L., *Ipomoea aquatica* Forsk., *Leucas linifolia* (Roth) Sprengel., *Melochia corchorifolia* L., *Nymphaea pubescens* Willd., and *Trianthema portulacastrum* L.

INTRODUCTION :

Nourishment of the people is one of the most important subject, and demanding attention of the government. Vegetables constitute an important item of human diet as they provide nourishment to the people. In the context of alleviating protein malnutrition in India, efforts are underway to enrich cereals. To supplement them vegetables can be used in very effective manner, particularly wild vegetables as they combine the advantages of vegetable and medicinal plant.

The present production and consumption of the vegetables in Bihar is inadequate, being only about one-fourth to one third of the requirement. In order to improve the quality of diet of the people it is essential that the production of vegetables should be increased considerably. This could be achieved by increasing the present area under vegetable cultivation, by increasing the yield per unit area, by adopting better agriculture techniques and by domesticating new vegetables from the wild. The word "vegetable" is here taken in a sense as wide as possible because each limitation seemed to be arbitrary.

Santhal Pargana has a vast and varied flora. Recently Sriwastawa (1986) surveyed Santhal Pargana and reported more

than thousand plants from this region. Perusal of literature on floristics and ethnobotany of Santhal Pargana (Bodding, 1925, Haines 1921-25; Goel et al 1984; Sriwastawa and Varma 1981, Sriwastawa 1986) reveals that in addition to common cultivated vegetables, a large number of wild plants are also taken as vegetables by the tribals of this area to supplement their food requirements. As these people usually live in hills and forests, they face problem of food scarcity for major part of the year. Still they show enough strength to undertake strenuous job. This amazing result can only be ascribed due to the strong substances present in their food and in the context of tribals use of various wild vegetable appears to be one of the factors responsible for providing nutritional reinforcement to these people. "No dish pleases all palates alike" is a wise maxim. We will be wise by not talking deprecatingly about the vegetables relished by the tribals.

Opportunity in a region like ours where greater part of the people eat no other than vegetable, food, there is ample for survey, collection, cultivation and documentation of some wild vegetable plants which are available in abundance in this part of the state.

METHODOLOGY :

The account given by previous workers appears to be comprehensive but is not quite complete. In order to catalogue the wild vegetable resources of Santhal Parqana survey work and studies were conducted in 15 selected tribal localities during 1986-89 in different seasons of the year. During the course of present investigation more than 200 field information as well as samples were collected, documented and deposited in Bhagalpur University Herbarium.

OBSERVATION

Scrutiny of field data and samples revealed that in all 62 vasculars plants from the wild are taken as vegetables by the tribals of this region. Of these 10 plants constitute roots and tubers, 25 plants young leaves and shoots, 5 plants flower buds, flower and inflorescence and 20 plant species fruits and seeds. The data is being presented in the tabular form under following heads :

1. Roots/Tuber/Rhizome (Table-1)
2. Tender shoots and leaves (Table-2)
3. Inflorescence, flower buds and flowers (Table-3)
4. Fruits and seeds (Table-4)
5. Pteridophytes (Table-5)

Botanical name of the plant is followed by local name and parts used as vegetable.

CONCLUSION

Perusal of above facts reveals that majority of wild vegetables are not taken by us. The chief reason being either we are ignorant about such plants or these vegetables are not available in the market. Besides this the method of cultivation appears to be major hurdle. Therefore, efforts should be made to popularise these vegetables by first establishing pilot nursery, where few selected plants mentioned above may be cultivated for mass consumption. In order to achieve this goal coordinated efforts of nutritional expert, agricultural scientist, voluntary agencies (such as Krishna Chandra Mishra Research Institute of Wild Vegetable Crops, Bandarwar) and the government needed.

ACKNOWLEDGEMENT

The authors are grateful to Prof. K.S. Bilgrami for providing facilities and to U.G.C. for financial assistance under grant No. F.3-16/86 (SR-II).

REFERENCES

Bodding, P.O. 1925 Studies in Santal medicine and connected Folklore-I. Santals and diseases. Mem. Asiatic Soc. Bengal 10(i) 1-132.

Goel A.K., A.K. Sahoo and V. Mudgal 1984 A contribution to the "Ethnobotany of Santhal Parg-ana" BSI.

Haines, H.H.	1910	A forest flora of Chotanagpur including Gangpur and Santhal Pargana.
Haines, H.H.	1921-25	Botany of Bihar and Orissa Repr. ed. Vol. I-III, BSI Calcutta.
Sriwastawa, D.K. and S.K. Varma	1981	An ethnobotanical studies of Santhal Pargana, Bihar. Ind. For. 107(I) pp. 30-41.
Sriwastawa, D.K.	1986	Floristic and Ethnobotanical study of Santhal Pargana. (Ph.D. Thesis). Bhagalpur University.

TABLE-1

Root, Rhizome, Corn/Tuber

Botanical Name	Local Name	Parts Used
Abelmoschus crinitus Wall.	Birkaskom (S)	Tuberous root
Amorphophalus paeonifolius Dennst Nicolson	Ol (S)	Corn
Colocasia antiquorum Schott.	Saru (S)	Rhizome
Dioscorea glabra Roxb.	Baiyang (S)	Tuber
D. pentaphylla L.	Kepu (S)	Tuber&Bulbil
Nelumbo nucifera Gaertn.	Uppalbaha (S)	Rhizome
Nymphaea pubescens Willd.	Bhent (P:	Corm
Pueraria tuberosa (Roxb. ex Willd.) DC.	Tirra (S)	Young tuber
Solena amplexicaulis (Lam.) Gandhi	At (S)	Tuberous root
Tacca leontopetaloides (L.) Kuntze	Dhai (s)	Tuber

S = Santhali

P = Paharia

IMPORTANCE OF WILD VEGETABLE CROPS FOR SOCIO ECONOMIC DEVELOPMENT OF TRIBALS

R.K. SINGH and V.K. SINGH,

Deptt.of Horticulture (Vegetable & Floriculture)
Bihar Agriculture College, Sabour
Bhagalpur - 813210

The districts of Ranchi, Hazaribagh, Lohardaga, Gumla, Singhbhum, Dhanbad, Gridih, Godda, Dumka and Sahebganj are predominated by the tribals. This plateau has been known for its rich mineral resources and there has been spurt in industrilization but the rural masses have remained poor and undernourished. Voluntary organizations and the Government have been putting forth endeavours for the upliftment of the tribals who depend on pretty land forest for their livelihood. For increasing the production in agriculture, attempts have been made to introduce new technologies but the responses have not come up to the desired expectation. Therefore, there is an urgent need for review and planning of development strategies.

While planning for the development of the tribals, the wild vegetables deserve due recognition. Undoubtedly, planned cropping of the wild vegetables like chichinda, kakrol, kundari etc. will play a significant role as the plateau is endowed with the climatic conditions favourable for growing

these vegetables. This would provide the opportunity for better employment and put the marginal and waste land under use which is otherwise left uncultivated, and made subject to soil erosion and loss of soil fertility. With sincere efforts it would not be difficult to popularise these vegetables with tribals who have much affection for them. Definitely the attempts may alleviate the poignant human stresses viz, poverty, hunger, malnutrition and social unrest. What is needed is to plan out the strategy and prepare an infrastructure well supported by research and marketing facilities.

These vegetables are rich sources of vitamins and minerals and supply a very good amount of roughages. The important ingredients of the most popular wild vegetables Momordica cochinchinensis and M.dioica cited below clearly signify their importance.

Ingredients	M.cochinchinensis	M.dioica
Moisture (%)	84.09	84.10
Protein (%)	2.61	3.10
Carbohydrate (%)	5.69	7.70
Crude fibre (%)	5.93	2.97
Iron (mg/100 g)	21.00	33.00
Phosphrous (mg/100g)	148.00	42.00

These vegetables are ideal for patients of diabetes and gout. These vegetables are not bitter in taste. These can be grown under rainfed condition on lands which remain barren due to lack of irrigation fascilities and the waste lands can be utilized. Wild vegetables can be grown with a limited amount of fertilizers ranging from 50-60 kg nitrogen, 20-30 kg phosphorus, 20-30 kg potash, 100-120 quintal compost per hectare.

Problems faced by the tribals in popularising these vegetables and their solutions.

1. Lack of planting materials :

These are mostly propagated by seeds and tuberous roots. In case of Momordica cochinchinensis and M. dioica propagation by tuberous root should be preferred. Here, the underground roots are not easily available because the owner does not want to part with them. Also these roots are not easily detectable in the off season. This limits its large scale cultivation. The owner should be persuaded to supply the planting materials to their neighbours. Alternatively the Government or some voluntary organisations should take a lead for maintaining these roots and supplying to the growers. These two wild vegetables may also be propagated by seeds. But cultivation by seed is limited because -

(i) The fruits are mostly consumed while still green, their seeds are not available on commercial scale. Some Government agencies or voluntary organisation may produce seeds and make them available to the growers.

(ii) Fresh seeds do not germinate, but remain dormant for about nine months. In the first year of its life the seeded vine of Momordica cochinchinesis may not bear fruits. Moreover the seeds give mostly vines that bear male flowers (48.7% female and 51.3% male).

These may be propagated by stem cuttings by treating the cuttings with 500 ppm NAA. The planted cuttings should be kept in a lighted place but away from direct sunlight. The cutting should be sprayed regularly with water from a sprayer or atomizer. The months of July and August are the most suitable. The rooted cuttings should be planted in the main field after 20-30 days.

2. Lack of appropriate cultivation techniques :

The tribals are not aware of appropriate cultivation techniques. Hence, the Government should organise short training courses for the tribals to educate them about the cultivation practices of these vegetables. The voluntary organisations may also come up for imparting training to the tribals.

3. Lack of suitable plant protection measures :

These crops are attacked by a number of insects pests and diseases. As a preventive measure against pests carbofuran 1 to 2 g per basin should be applied after a week of sowing or transplanting. At fruiting stage of crops, Malathion 50 EC (2 cc per litre water) mixed with Dithane M-45 (2.5 g per litre water) should be applied.

4. Pollination problems :

Fruit set in most of the wild vegetables is unsatisfactory. The average fruit set of tetraploid variety of Momordica dioica is only 22.89 per cent. The fruit setting in diploid variety is still worse. It flowers at night when natural pollinating agents are fewer.

For effective pollination, hand pollination is advisable. An economic alternative will be to keep an apiary. Bees are more efficient than man in pollinating cucurbits.

5. Lack of preservation fascilities :

During the season of production, the produce becomes glut in the market and the growers get very low price of the produce. So the tribals should be trained in the home preservation of these vegetables.

6. Lack of marketing facilities :

These vegetables are very costly, costlier than most of the commonly grown vegetables, because the marketing facilities are not available and the growers are forced to sell their produces through the middle men in the local market. Hence marketing facilities should be encouraged so that tribals may get more benefit out of their produce.

7. Lack of irrigation facilities :

These vegetables are presently grown mostly on unirrigated land. By providing irrigation facilities the yield of the wild vegetables may be doubled and the economic condition of the tribals is bound to improve as they will get more return per unit area.

8. Lack of high yielding varieties :

Breeding work for evaluation of high-yielding varieties has not yet been undertaken in any of the agricultural universities of the country and the government agencies due to which no improved varieties are available with the tribals. Hence, the tribals are getting very poor yield from the local varieties. So an attempt should be made by the govt. to establish some govt. organisations or encourage the voluntary organisations to evolve high yielding varieties of these vegetables.

9. Lack of loan facilities to the tribals :

The tribals are mostly poor and can not afford to spend money required for improved cultivations of these vegetables. Hence, the government should extend loan facilities to the tribals so that they can raise a good crop and cosequently improve their socio-economic status.

WHY NOT DOMESTICATE WILD VEGETABLES

M.M. PUJARI and G.M. MISHRA

Deptt. of Horticulture (Veg.& Floriculture)
Bihar Agriculture College, Sabour.

The cultivated vegetable crops provide insufficient quantity of mineral and vitamins. If it is replaced by wild vegetables like Kundru (Coccinia grandis), Tinda (Citrulus ulgaris) and others, it will supply more quantities of minerals and vitamins needed for balanced diet. In India and particularly in Bihar there are vast cultivable area available for its large scale cultivation. In addition these crop possess a good quality of being reqistant to insects pests and diseases, which are major limiting factors in successful cultivation of cultivated vegetables.

The importance of vegetables in the daily diet of man hardly needs to be emphasised. These are essential ingredients of a balanced diet. However, unfortunately the diet of an average Indian can hardly be said to be balanced. According to dieticians, for a balanced diet, an individual should consume about 155 g each of leafy and other vegetables and 70 g of root vegetables daily. The majority of population in India being vegetarian, the quantity should be even more.

Our population take common vegetables in small quantity than advanced countries. These small quantity give insufficient amount of minerals and vitamins. If, we use the same amount of wild vegetables they give more nutrition than cultivated vegetables. Some of the wild vegetables which are grown easily in different parts of the country are Kundru (Coccinia grandis) 'Sakalu' (Dolichos erosus), 'Ratalu', 'Suthani' (Dioscorea), Elephant foot, (Amarphophallus paeonifolius), 'Bhat karela', (Momordica cochinchinensis), 'Tinda' (Citrulus vulgaris) var, fistulosus) and Tapioca (Manihot esculenta), etc. The nutritional value of the cultivated and wild vegetables are as follows.

Our country has wide range of climate and soil and cultivation of crops differ depending upon the climate and soil condition of the particular area. The wild vegetables possessing genetically wild character can be successfully grown in most part of our country. The requirement of a good soil is also not a limiting factor, therefore, it can be successfully grown in hilly areas, marshy land and arid zone. In our state, Chotanagpur plateau, and other terrian region and where there is no drainage problems, the wild vegetables like kakora (Momordica dioca), Dioscorea, Momordica cochinchinensis may be cultivated with good yield.

TABLE - 1

Approximate composition of Vegetables

(Per 100 gm. of edible portion)

Sl No.	Name of Vegetable	Protin (g)	Fat (g)	Carbo hydrate	Cal- cium	Iron (g)	Vitamin-C (/mg)
1.	Cauliflower	2.6	0.4	4.0	33	1.5	56
2.	Tomato	0.9	0.2	3.6	48	0.4	27
3.	Brinjal	1.4	0.3	4.0	18	0.9	12
4.	Chillies- (green)	1.3	0.6	3.0	12	1.0	103
5.	Okra	1.9	0.2	6.4	66	1.5	13
6.	Carrot	0.9	0.2	10.6	80	2.2	3
7.	Onion	1.2		11.0	180	0.7	11
8.	Radish	0.7	0.1	3.4	50	0.4	15
9.	Cucumber	0.4	0.1	2.5	10	1.05	7
10.	Pointed-gourd	0.2	0.1	3.0	30	1.7	29
11.	Tinda	1.4	0.2	3.4	25	0.9	18
12.	Elephant foot	1.2	0.1	18.4	60	1.3	
13.	Colocasia	0.3	0.3	4.2	60	0.5	3
14.	Momordica diocia (Kakora)	3.1	0.2	7.7	33	4.6	275

In the present day technology, an improved agro technique is by and large adopted by the farmers for good return. The cultivated vegetables as envisaged in modern technology requires good land preparation, propagation

methods, irrigation facilities, fertilizer requirement and all possible plant protection technique for good return. These improved practices require large investment and a good deal of man power, whereas the wild vegetables require a meagre investment with quite low man power.

In addition, it is a well known fact that good harvest depend upon the weather condition, for cultivated vegetables, whereas these wild vegetables being wild in nature can withstand the adverse weather condition.

There is a very important stand-point in favour of domestication of wild vegetables in terms of their very low perishable in nature, while as the cultivated ones lack of this very important qualities.

This quality has raised its importance in transportation from one place to another place.

It is commonly observed that the harvesting period of the cultivated one is very short, while it is harvested for a long period and it can supplement during the lean period of availability of common vegetables particularly in early summer.

It is also well known fact, that cultivated vegetables require frequent application of toxic substances for protection against pest and good harvest. The use of toxic

substances lead to pollution and hazardous to man and animals. The wild vegetables require no plant protection measures like use of toxic substances, therefore, it can be duly given more importance for cultivation in large area.

One important consideration for its domestication is due to its high fetching prices in comparison to the cultivated one. This high price is due to less availability of these vegetables in market.

Now, taking together the economic return and nutritive value, the wild vegetables should be grown in large scale.

DOMESTICATE PARWAL IN UPLAND

D.N. CHOUDHARY and G.M. MISHRA

Department of Horticulture
Bihar Agricultural College, Sabour.

Parwal (pointed-gourd) is one of the most nutritive and wholesome vegetables. It is easily digestible, diuretic and laxative, invigorates the heart and brain and is useful in disorders of the circulatory system. Leaves and tender shoots of the vine are also used for making soup and unripe fruits for culinary and sweet.

Pointed-gourd (Trichosanthes dioica Roxb.) belongs to the family cucurbitaceade, is a native of India. Wild forms of parwal are founded throughout North India. The Bengal-Assam area is considered to be the primary centre of origin. This crop is widely cultivated in Assam, Bengal, Bihar and Uttar Pradesh.

It is extensively grown in Bihar, especially in North Bihar and mostly on the banks of the Ganges and Eastern U.P. But it can also be cultivated in upland with some manipulations of soils.

Climate and soil :

It flourishes in a hot and humid climate and is best suited to places where rains are abundant. Though it can be

grown various types of soils, which are free from bad drainage, yet sandy to sandy loam soil is best suited to it. In north Bihar, the areas useually flooded by rivers during the rainy season are utilized for growing parwal during summer. Besides alluvial soils, silty loam and clay loam are also suitable, provided they are well drained and rich in plant nutrients. The plants are very sensitive to water logging.

Soil preparation :

First ploughing should be given by mouldboard plough during the hot weather and subsquent 3-4 ploughings by desi plough or cultivators to make the soil well pulverised and friable. Each ploughing should be followed by pata.

Manures and fertilizers :

Being a perennial crop, there is continous uptake of plant nutrient from the soil. Hence, the field should be heavily manured every year. Usually cultivators do not apply any fertilizer in diara land but manures and fertilizers are very essential for its successful cultivation, especially in upland. For better yield, 250 quintals of F.Y.M., 80 kg of nitrogen and 80 kg of Phosphorus per hectare should be applied.

The phosphatic fertilizer and half of the total nitrogenous fertilizers should be added before the growth is

resumed in spring and the rest of the nitrogenous fertlizers a month later. Next year, 100 g ammonium sulphate and 1.25 kg F.Y.M. should be given per plant in September October.

Varieties :

The crop is cloncally propagated and so good varieties with attractive fruit characters are available in parwal growing areas. In Bihar, recognised varieties are Dandali, Hilly, Sofeda, Santkhva, Nimiya and Sonepuri. The fruits range from small round to long tapering at both ends. The colour varies from light to deep green with or without stripes.

Method of propagation :

The pointed-gourd is one of the rare cucurbits which is propagated by cuttings. Vegetative propagation by stem cuttings is the most satisfactory method of multiplication of this crop. Cloneally propagated plants breed true and ensure uniformity of the crop. The growers are advised to make out healthy, vigorous growing, high yielding plants to be used as parent material for future multiplication. Male and female flowers in parwal are found on separate plants. Both male and female plants should be planted for high yield. It has been observed that 5-10 per cent male plants in the field are adequate to provide enough pollen needed for pollination. Cuttings should, therefore, be taken from the marked plants

(male and female). Male flowers are bigger than female flowers and have a long base while female flowers end in a swelling covered with a fine white pubesence which is the ovary. Cutting made from the basal portion of the vines record over 90 per cent success. High mortality percentage is often noticed with terminal cuttings. Each cutting is about a matre long and is folded in the form of a "Lachchi" resembling the numerical figure eight (8) of 30 cm long. The cutting are planted 2 metres apart both row to row and plant to plant in the field. Two methods of planting are usually followed. In first method, the "Lachchi" is buried 12-15 cm deep in the field with its knot in the centre. In second method, a bundle of twisted stems, 30 cm long, is buried in patch about 10 cm. deep in such a manner that the two ends of the cutting are exposed white the middle portion wound round the lump of earth is burried. To plant one hectare, there is need of 2500 cuttings. The crop can also be propagated by seed but this is done only when breeding for new varieties. Seed propagation is not desirable due to cross pollination nature of the crop. 25 kg of seed would be enough for sowing one hectare of land. Plants propagated from seed produce large population of plants in the field often resulting in male and female plants in the ratio of 50:50 so much of the flowering males are to be uprooted after they start.

Cuttings are planted in July-August or September-October to March if irrigation facilities are available. The plants bear flowers and fruits during hot summer months from March to October. With the rise in temperature in spring, the vegetative growth is initiated around first week of February. After the fruiting season is over in October, the vines are severely pruned and left for rest during winter season.

Irrigation :

No irrigation is required for rainy season planting but cuttings planted in February-March and September should be irrigated 5 to 6 times as the need may be before the monsoon starts.

Inter culture and other operation :

The vines are pruned severely at the end of cropping season in October. The entire plant (vine) is cut away leaving 10-15 cm long basal portion of the main branches. Afterwards, the soil near the parwal root is loosened, manured and then irrigated. No special graining of vine is required when grown in open field as a main crop. The vines which are allowed to grow spread over the ground are more vigorous, bear more fruits and are less damaged by the fruit fly. However special care is required to train the vines on poles, when it is grown as mixed crop along with betel vines.

Female plants close to male plants relatively set more fruits than those way from it. Though, both male and female flowers at night, yet female flowers open in 8 to 12 days male in 12-16 days from their appearance. The stigma remains receptive from 7 hours before opening till 51 hours after opening. It, therefore, becomes necessary to have male and female plants, planted side by side. Bees have been found to be the most effective agents involved in pollination. The flowers open in the early hours of the night and fertilization is affected in about 6 to 12 hours after pollination. Colour of the ovary and its size are the chief indication of fruit formation, which is accomplished after 2 days of pollination.

Plant protection mesures :

Parwal is attacked by a number of disease and insects pests. In some areas, these are the main limitations in profitable production of the crop. The most important diseases are bacterial wilt, anthracnose, downy and powdery mildews. To control bacterial wilt and anthracnose, crop rotation, eradiction of weeds, seed treatment and spraying or dusting with copper compound are recommended. To control mildews, Karathane and Morestan dusting and Bavistin (Systemic fungicide) spraying have been found more effective. Parwal is attacked by many insects. The insects not only

damage the plant parts but also help in life transmission of a number of diseases. The most important insects are red pumpkin beetles, aphids and fruit fly. To control these insects, crop rotation, eradication of weeds and spraying of Malathion at suitable intervals are recommended.

Harvesting :

Fruits are picked when they are still young and green. After harvesting, they are packed into baskets, bags and in crates, according to the distance of the market.

Storage :

Fruits can be stored 4 to 5 days in an ordinary condition in good quality.

Yield :

It varies according to planting. The yield from first crop varies from 80-100 quintals, while the next year 110-160 quintals per hectare. The crop should not be kept for more than 3-4 years.

Problems of successful cultivation :

1. Parwal is largely grown in diara lands due to favourable climate and soils.
2. Lack of high yielding and resistant varieties against disease and pests.

3. Sand blowing cause severe damage to foliage and restrict fruiting.
4. Fruit fly menace is important both in 'diara' and upland.
5. Fruit rot and vine rot cause severe loss to parwal in diara and upland and untimely rains during April-June further intensify these problems.
6. Very dry atmosphere in April - May alongwith westerly wind arrest the vine growth and hamper fruiting.
7. Viral diseases cause damage to the crop.
8. Maintenance of male and female plant ratio for proper pollination.
9. Lack of suitable plant protection measures for controlling diseases and insect pests.

Future Plan/Suggestion for successful cultivation :

Efforts are being made :

1. to identity and develop suitable varieties for different seasons, conditions and situations.
2. to standarise appropriate agro-technniques for different conditions and situations by adding lime and sand in upland condition.
3. to maintain the male and female plants ratio in appropriate proportion.
4. to formulate easy and economical plant protection measures to combat disease and insect pest problems.
5. to introduced physiological manipulation to enhance yield and improve quality.

So, parwal can be domesticated in upland conditions also for higher yield, better return and to raise the economic condition of poor farmers of the country keeping in minds the aforesaid valuable suggestions.

VEGETABLES : THE RICH SOURCE OF MINERALS AND VITAMINS

M.M. PUJARI and B.P. JAIN

Deptt. Hort. (Vegetable & Floriculture)
Bihar Agricultural College, Sabour.
(Bhagalpur).

The importance of vegetables in the daily diet of man hardly needs to be emphasised. These are essential ingredients of a balanced diet. An average Indian consumes 375 g of cereals and starchy roots and vegetables only 30 g. According to dieticians for a balanced diet, an individual should consume about 115 g each of leafy and other vegetables and 70 g. of root vegetables daily. The majority of population in India being vegetarian the quantity should be even more.

Vegetables are protective supplementary foods and are rich source of vitamins and minerals which are so important for our health. Many of the vegetables contain large quantities of calcium and phosphorus. Although, vitamins are found in small quantities, their effect on our health is indeed great.

Amongest the vegetables, leafy vegetables also have high protective value. The leaf of a plant is the store house of many nutrients essential for the human body. It is the leaf

where all four factors such as proteins, carbohydrates, fats, vitamins and minerals comound are synthesised. Due to richness in minerals, it is more helpful to maintain the system of the body in normal condition due to alkaline nature.

Role of Minerals :

Vegetables are rich in minerals. Each and every vegetable has sufficient amount of different minerals. But leafy vegetables have rich sources of minerals like Potassium, Calcium, Sodium, Magnesium, Phosphorus, Chlorine, Sulpher, Iron, Copper and other minerals needed by the human body. Calcium is needed for healthy bones and for resistance to infections. Iron is an essential part of the red blood corpuscles and is the best known oxygen carrier in the body. Phosphorus is essential for all active tissues of the body.

Proteins :

Leafy vegetables are good sources of proteins, Human body tissues are alkaline and it is essential that for good health a proper alkaline reserve is maintained in the body. Proteins are essential for proper health.

Carbohydrates :

Carbohydrates are important caloric-yielding food and are easily digested. Carrot, Onion, Elephant foot and leafy

vegetables contain high percentage of carbohydrates. Gram leaves contain 27.2 percent carbohydrates.

Fats :

Nearly all the greens are very low in fats. Because of the very small amount of fat present in them, it is easy to digest them.

Fibre :

Vegetables contain cellulose as fibrous matter and moisture which provide necessary roughage in the diet and stimulate intestinal action and cures constipation. All the vegetables are good in percentage of fibre.

Daily requirement of vitamins :

The minimum and optimum daily vitamin requirements of man have been broadly suggested as follows :

Table - 1.

Vitamin requirements of an average person :

For a man of 70 Kg.	Vit. A (I.U.)	Vit. B (I.U.)	Vit. C (I.U.)	Ribolflavin (mg.)	Nicotinic acid (mg.)
Minimum requirement	3000	300	30	---	---
Optimum requirement	5000	600	75	2.7	18.5

Role of Vitamins :

Vitamin A is essential for growth and reproduction. Its deficiency in diet can cause night blindness, sore eyes, formation of stones in the kidney and bladder, xerophthalmia, dryness, pimpling and eruption of skin. All these result in retarded growth of the child.

The deficiency of vitamin B in the diet can cause beri-beri disease, loss of appetite, loss of weight, fall in the body temperature, fall in the growth and reproduction rate, sour mouth and pellagra disease.

Vitamin C

Vitamin C is soluble in water and is essential for general good health. Its deficiency in body may cause unhealthy gums, tooth decay enematism, scurvy, loss of energy, delay in wound healing, enlargement of heart and damage to heart muscles.

Vitamin D

Vitamin D is a fat soluble antiricketey. A good supply of vitamin D is essential for proper bone formation and healthy teeth. It helps in the clacification of bones by proper utilization of calcium and phosphorus salts.

Vitamin E

Vitamin E is a fat soluble and anti sterility vitamin. It is essential for reproduction.

Vitamin content of Vegetables :

Vitamin A content of green vegetables vary according to the variety and the season. On an average four onces of green contain 2000 to 12000. I.U. of vitamin A which are adequate to meet the daily need of a person. The vitamin B is irregularly distributed in vegetables and seems to be more concentrated in seeds than leaves of peas and beans. The vitamins content of different vegetables have been mentioned in the (Table-II).

PARWAL GROWS ECONOMICALLY IN NORTHERN INDIA

M.M. PUJARI and RAJESH KUMAR

Deptt. of Hort. (Vegetables & Floriculture)
Bihar Agriculture College, Sabour,
(Bhagalpur).

Parwal or pointed gourd (Trichosanthes dioca, Roxb) is an indigenous vegetable crop of India. It is a popular and economic vegetable crop and is clonely cultivated in Bihar, Bengal, U.P. and Assam. The fruit is easily digestibale, diuretic and laxative invigorates the heart and the brain and is useful in disorders of the circulatory system. Parwal leaves with bark of neem are used for the treatment of leprosy. The parawal vine which are grown for its delicious, slightly bitter, tasty fruits need particular care in cultivation. The cultivation may be extended successfully to other areas. The attempt have been made to describe the morphological characters of some of the important cultivars of parwal grown in northern India.

Varieties :

1. Dandali : Medium size (6.84 x 3.89 cm,) egg shaped, light green, plump, stock and despressed, stripe 8-9, slightly grooved, especially towards distal end.

2. Shankholia : Medium long size (7.56 x 2.94 cm), form resembles like that of a 'shankh' and is tapering towards ends, greenish with more or less white stripes (8-9), slightly beaked towards fruit end and bulged towards stalk.

3. Chhota Hilli : Medium long size (5.71 x 3.37 cm), form oval to spindle shaped swollen in the middle, greenish with prominent white stripes (9-10), blunt on fruit end and bulged at stalk.

4. Hilli : Long size (9.63 x 3.08 cm), form oblong, greenish more or less white stripes (9-10) tapering towards flower end and with a depressed neck at stalk. Other varieties i.e. Nimia, Santokhwa, Mridangia, Safeda, Bagrolia, etc. are cultivated locally.

Climate and soil : Parwal is a warm season, perennial vegetable crop and is grown successfully for three to four years. It thrives in hot humid climate with abundance of rainfall and grows well during the hotter part of the year to cool winter months. For successful cultivation, a warm and well distributed five to six light rains during December to June are essential for good vegetative growth and fruiting. It requires calcarious, sandy loam soil containing sufficient organic matter and alluvial soil along the river belts for best growth.

Propagation and planting : Vegetative propagation through vine cuttings is the most satisfactory method of multiplication of the crop. The growers are advised to mark out in the field, healthy, vigorous growing, high yielding plants to be used as parent materials for further multiplication. Cutting made from basal portion of the vines record over 90% success.

Manure and fertilizers : Manuring is essential for high yield and better quality. Cultivators growing parwal near river belts, however, do not apply manures. Being a perennial crop there is continuous uptake of plant nutrients from the soil. Hence the field should be heavily manured every year. 200-300 q. of F.Y.M. and 6-10 q. caster cake per hectare should be applied or 20-25 tons of F.Y.M. , 40 kg nitrogen, 40 kg. Phosphorous and 40 kg Potash per hectare can be applied for successful crop production.

Irrigation and interculture : Irrigation at 25 days interval is essential during winter and spring. Cheap and plentiful water is pre-requisit for parwal cultivation; since the plant grows and bears the crop during the summer months. In rain-fed areas like Assam, irrigation is not necessary in each month. Hoeing is beneficial after each irrigation. Hoeing around the root zone is essential for respiration activity of the roots and conserve moisture in the soil.

Therefore, two hoeings in every month are essential for good fruiting. Mulching has also been found beneficial particularly at the root zone.

Training and rejuvenation of vines : No special training of vine is required when grown in open field as a main crop. However special efforts are required to train the vine on poles whwn it is grown as a mixed crop along with betel vines in especially erected closed bamboo thatched enclosures.

For obtaining good return in the second and third year, it is most essential that the vines from which fruits have been taken should be cut at the end of September to October leaving 2-3" vine attached. In November new shoots emerges out which starts fruiting from March to October.

Pollingation and fruit setting: Presence of enough number of male plants in field and right type of pollinizers ensures heavy fruit setting. Parwal is dioecious plant, so at least ten per cent male plants in the field are essential to ensure availibility of enough pollen required for fertilization and fruit setting. Female plants close to male plants relatively set more fruits than those away from it. Male and female flowers open at night. Female flowers open in 8-12 days and male in 13-16 days from their appearance. The stigma remain receptive from 7 hours before opening till 51 hours after opening. It is, therefore, necessary to have male and female vines planted side by side.

Harvesting : Prawal is a potential vegetable crop and fruits are available for a long period from February to September. Vines begin to fruit after 5 months of planting. It has been observed that picking at weekly intervals gave more yield. To get a continuous supply, all fruits should be picked at the tender satage. If the fruits are allowed to ripen on the vines bearing will receive a set back.

The yield varies from place to place depending on soil and climatic conditions. About 100-150 quintal per hectare yield is harvested in first year and the yield increases in the second year, but declines repidly in third and fourth years of plantation. A net return to a tune of Rs.7,500, per hectare per season has also been obtained from good harvest, the return is more in second season.

Diseases and pests : The most common disease of this crop is powdery mildew. This disease develops under more warm and humid conditions. This can be recognised by whitish gray coating on the surface of the leaves. Dusting 20-15 Kg. per hectare of sulphur dust to the crop in early stage can check the spread to the disease. Among the insect pests, fruit fly is the serious pest of the crop. It causes rotting of fruit. For the control of fruit fly grow resistant variety to pest and ttacked fruits should be destroyed.

Thus, Parwal can be considered a gold earning crop and is a prized vegetable of northern India. Three to four vines in a kitchen garden would sufficient the need of this crop. Importance of parwal increases further due to its availibility during hot dry summer and medicinal properties available in its fruits. Proper attention is, therefore, to be paid for the improvement in its cultivation and expansion of areas under this crop.

REFERENCES :

1. Dubey, K.C. and Pandey RP — 1973 Parwal cultivation in M.P. hold promise Indian Horticulture 18(3), 15-16

2. Gupta, Utpal — 1963 Why hot grow patal this summer. Indian horticulture 7(3), 28-29.

ELEPHANT FOOT (*Amorphophalus paeonifolius* DENNST)

D.N. CHOUDHARY and G.M. MISHRA,

Department of Horticulture (Veget. & Flori.)
Bihar Agricultural College, Sabour, Bhagalpur.

The Elephant foot (Ol, Suran or Zamikand) belongs to the family Araceae. The Elephant foot originated in India and is grown for its corm or tubers which are used as vegetables. In action it is stomachic and tonic, used in piles and given as a restorative in dyspepsia and debility, etc. it is a hot carminative in the form of pickle. Its root is used in boils and opthalmia and also as an emmenagogue. Tubers contain an acrid juice which should be got rid of by thorugh boiling and washing with calcium hydrooxide and salt lest it should irritate the mouth and fauces. It is regarded good in haemorrhoids. It is richer than potato in minerals and vitamins A and B. The acrid and irritating taste is due to the presence of calcium oxalate. It is grown on large scale in Maharashtra, Gujarat and other parts of peninsular India.

Climate and Soil :

It is tropical and sub-tropical crop. It requires a well distributed rainfall with humid and warm weather during vegetative developments, while cool and dry weather during the development of corms. Continuous rains and waterlogging

are harmful to its growth. Though it can be grown from light loam to heavy soils if they are free from bad drainage, yet it thrives best in highly manured and deeply dug sandy loam soils.

Soil Preparation :

First ploughing should be done with mouldbold plough and subsequent 4-5 ploughins with deshi plough and cultivators. The land is ploughed 20-25 cm deep for it to make the soil friable. Each ploughing should be followed with planking (Pata).

Manures and Fertilizers :

The crop should be fertilized with 250 quintals of F.Y.M., 100 Kg. N, 40 Kg P O and 60 Kg K O per hectare. The half dose of nitrogenous fertilizers and full dose of P and K should be applied at the time of land preparation. Remaining half dose of nitrogenous fertilizers should be given in two equal split doses at 45 days intervals.

Varieties :

There are no improved varieties of 'Oi'. Cultivators grow the local types generally. The Elephant foot is of two types, viz. one has smooth corms and is propagated by cutting the corms into pieces. This variety causes irritation of the throat when eaten yet is grown because of its higher yield and lower price of seed (corms). The other kinds has daughter

corms growing on the parent corm and is much superior to the former type. It is edible quality and is almost non-irritating if cooked properly. Its seed (corm) is more expensive and its yield is less but the produce fetches a better prices is in the market.

Planting Methods :

It takes about four seasons to produce a good crop of marketable size. It is grown from small tuberous out-growths called as 'buds'. These buds are planted in flat beds or in ridges. Planting distance varies according to the size of the corm or planting bud from 15-20 cm apart to 60-75cm.

Planting time :

The planting time for Suran (01) in south India is the month of May, While in north India, it is February to March. Corms should be planted after giving them a rest for about 2 to 3 months. The tubers/buds should be treated with Potassium permagnet or Agalol solution before planting.

Irrigation :

The crop of Elephant foot is irrigated well during summer season. There is no need of irrigation during rainy season. Generally 3-4 irrigations are required in summer. When the crop is nearing its maturity, give light irrigations at long intervals till the crop is harvested.

Intercultural Operations :

Two to three weedings should be done to keep down the weeds from the fields.

Plant Protection measures :

Generally, diseases and insect pests do not damage this crop. If these appear suitable plant protection measures should be provided to get the maximum yield.

Harvesting :

The crop is harvested when it starts withering in the month of October-November during 'Diwali'. It has been observed that the average weight of the corms produced is about 7 times the weight of the corms planted. Harvesting is done by digging the corms individually by a spade. The buds on the fourth year corms are removed and preserved for planting as a first year crop.

Yield :

The yield per hectare is about 400 to 500 quintals of corms in the mature stage.

Storage life :

It can be stored for a very long time without any damage.

BANKUNRI-A WILD VEGETABLE CROP OF BIHAR

KISHORE CHANDRA MISHRA

Krishna Chandra Mishra Research Institute of Wild Vegetable Crops, Bandanwar 814 147, Godda, Bihar

'Bankunri' (Solena amplexicaulis) (Lamb.) Gandhi Syn. Melothria heterophylla (Lour), is a wild vegetable crop of Bihar.

The species is highly and continuously variable in leaf shape, fruit and seed character. The leaves vary from broadly ovate cordate and unlobed to deeply palmatised into narrow, linear lobes, the fruit from smooth and ovoid to distinctly ribbed and or ellipsoid-rostrate, the seeds from smooth and devoid of a distinct margin to strongly marginate and/or rugose. Although majority of the specimens collected from this area are dioecious some monoecious population has also been reported. Accordingly specimens previously recognized on account of differences in fruit and seed morphology and sex expression can no longer be maintained as distinct.

Solena amplexicaulis is a wild vegetable of family Cucurbitaceae having tuberous root. Male flowers are in corymbose raceme. Female flowers are solitary on short peduncle. The somatic chromosome number is (2n=24). A natural tetraploid also exists.

It flowere in May-June under wild condition. Under irrigated condition it flowers during March-July if early irrigation is provided to the crop. The fruiting takes place from June to September.

Geography and ecology

It is found throughout India, also in Nepal, Sri Lanka, Bangladesh, China, Vietnam, Malaya and Java. It has been reported to occur in Assam, Western Ghats, U.P. and Santhal pargana of Bihar.

It is found on the sides of wet streams in the spring after an early shower of rain. The vine sprouts from the underground perennial tubers. It comes up with leafless or small leaves on fast growing stem with flowers within a month and half. The fruiting takes place in restricted vine growth in May-June after 45-60 days of sprouting. If the climate remains favourable and precipitation is high a second fruiting takes place after proper vine growth in September.

'Bankunri' is usually found in hills on thorny hedges which protects it from grazing of animals and removal of tubers from man. The thorny hedges also provide staking to the vines. It requires perfect drainage and prefers slightly acid soil (pH 5.5 to 6.5), rich in humus and organic content content. The plant requires a temperature of 25 -35 for

proper growth and fruiting and annual precipitation of 800-1250mm. Male plants are less abundant. An isolated female plant gave fruits and seeds. The plants grown from seeds were female and gave fruits suggesting apomixis. It, however, requires further confirmation.

It is a plant of stable habitant and as such it needs to devote more energy to vegetative growth in order to compete successfully with neighbours. It is more tolerant to high temperature of summer than any other vegetable crop of the season. It is drought resistant. It can be grown on the hills where there is water scarcity during summer.

Nutritional importance

Green fruits of 'Bankunri' are highly delicious vegetable. Fruits are cooked when unripe. It is also eaten raw when ripe. Its tender leaves are also eaten. The under ground parts of the plants are boiled and eaten like sweet potatoes and are scarcity or famine food.

'Bankunri' is an important source of calcium. 100g of edible portion of it contains 66.5g moisture, 0.7g protein, 0.4g fat, 0.9g mineral. 1.6 g fibre 29.9g carbohydrate, 40 mg phosphourus, 200 mg calcium and 120 K cal energy according to the report of NIN, Hydrabad.

It is thus the richest source of calcium available in fruit vegetables. Calcium is required for proper growth of children and nursing mother. It is, therefore' desirable to grow this vegetable on a mass scale to remove calcium deficiency in the diet of tribal society.

Medicinal use

S. amplexicaulis is used in folklore medicine and has been described in Chakradatta.

Freshly collected leaves are finely grounded, squeezed and the juice so obtained is taken in dose of 10-20 ml, twice a day in case of diabetes.

Tuberous roots are cleaned, dried and powdered, then taken in doses of 2-4 g with fresh unboiled milk of cow twice a day in the early morning on an empty stomach and in the night just before retiring to bed in case of spermatorrhoea.

The root is made into a paste with that of Mimosa pudica which is converted into small tablets (equal to the size of black pepper) and is prescribed orally once daily for five days during the period of mensuration for antifertility.

It is used as stimulant, invigorating and purgative in gonorrhoea and dysuria it is also externally used in small pox.

Juice of leaves is used as a soothing application to the skin inflamed by the application to the skin inflamed by the application of marking nut.

Present status of cultivation

S. amplexicaulis is a wild vegetable. It is not cultivated in any part of the state or country. Fruits of S. amplexicaulis are collected by the tribal people from forests and they eat the green fruits as vegetable. The collection from forest is very small and the fruits are consumed locally, it is not enough for the market.

Main limitations to cultivation

1. Lack of planting materials such as tubers, seeds etc. are the main limitation to the cultivation of this vegetable crop.

2. The yield per plant is very low.

3. People do not know about the vegetable and its nutritive value.

4. It cannot withstand waterlogging and is, therefore, unsuitable for flood prone areas.

Breeding and germplasm

Germplasm of S. amplexicaulis were collected from Tikigora, Rajmahal hills and Gandeswari hills near Semra Dak Bunglow of Santhal Pargana and were grown in the experimental garden of the Institute for study.

Aerial parts of the plant died on transplantation and did not sprout again. The plant sprouted from the underground tubers in the following year. Out of the two tubers planted in 1983 only one sprouted in 1984 and it was a female plant. There is no male plant around 5 kms from the Institute. The female gave fruits, plants raised from the seeds of this fruit also gave fruits in 1986. In 1984 and 1985 many tubers were collected from Rajmahal hills and Gundeswari hills and grown in the Institute. Regeneration of plants from tubers was very low only upto 2%.

In 1984 vegetative propagation of the plant using stem cuttings with single node and leaf using root promoting plant hormone was successfully tried.

'Bankunri' can thus be propagated by tubers, microtubers produced by one year old cuttings, seeds and stem cuttings.

The tuber is attached by soil born fungus and use of fungicide is recommended in transplatation. The crop should always be grown on bounds to avoid waterlogging. The leaves and fruits are attacked by Margorina indica

Recommendations

Forests of Godda districts are being cut down indiscriminately for fuel and staking of vines. Exploitation of coal (Eastern Coalfield Ltd, Lalmatia), grazing of cattle and taking tuberous roots as sweetpotato during famine have drastically reduced forest reserve of this vegetable.

1. It is, Therefore, nessary to conserve this local genotype by collection, vegetative propagation and cultivation.

2. Germplasm from other places should be collected and evaluated.

3. Attempts should be made to breed new high yielding strains, and colchitetraploids.

REFERENCES

Anonymous — 1962. The wealth of India, Raw Materials, Publication & Information Directorate (CSIR), New Delhi, Vol VI, L-M 335-336.

Anonymous — 1971 Nutritive Value of Indian Foods National Institute of Nutrition pp 75&79.

Chakravarty, H.L. — 1952 New finds of Indian Cucurbitaceae. J. Bombay nat. Hist. Soc. 50(4): 899

Cooke, Theodore, — 1958. The Flora of the Presidency of Bombay VolI. Bot Survey of India, Calcutta, Reprinted edn,

Duthie, J.F. — 1960 Flora of Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalyan Tracts Bot. Survey of India. Calcutta Vol 1:347.

Dixit,R.S. and Pandey H.C. — 1984 Plants used as folk medicine in Jhansi and Lalitpur section of Bundelkhand. Int. J. Crude Drug Res. 22(1) : 47-51.

Haines, H.H. 1910, Forest Flora of Chotanagpur including Gangpur and the Santhal Parganas Messrs Bishen Singh Mahendra Pd Singh Dehra Dun : 165.

Jeffery, C. 1980. Further notes on Cucurbitaceae:V The cucurbitaceae of the Indian subcontinent. Kew Bull. 34 (4): 793.

Kumar L.S.S. and Vishveshwara, S. 1951 Chromosome numbers of some wild Cucurbits (Letter). Current science., 20(8): 211-12

Maji, and Sikdar, J.K. 1982 A taxonomical survey and systematic census of edible wild plants of Midnapore district, West Bengal J. econ. taxon-Bot; 3:729.

MANAGEMENT OF HILL AND FOREST SOILS FOR VEGETABLE CULTIVATION

Dr. R. UPADHYAY

Sr. Scientist Cum Assoc. Prof.
Bihar Agricultural College,
Sabaur, Bhagalpur - 813210.

INTRODUCTION

In Bihar hill and forest soil and adjacent soils have an area of about 1500 thousand hectares. Though these soils have a poor fertility status, these soils are well drained and have plenty of staking materials to support vines of vegetable crops. The talk gives methods of improving these soils for profitable vegetable production.

In the state of Bihar hill and forest soils covers an area of 1360.7 thousands hectares and adjacent foot hill soils covers about 82.5 thousand hectares. On the basis of physiography, hydrology and fertility these soils are grouped as very poor for vegetable cultivation. Sufficiently large area of such soils falls in the southern part of Bhagalpur and Munger district and major areas are located in Chotanagpur plateau of this state. These soils are always free from water loging and thereby there is ample possibility to grow vegetable all the year round in such soils. The

economic sdtatus of farmers can be greatly improved with adoption of vegetable cultivation because vegetable cultivation is more remunerative. A good crop of vegetable can be taken up adopting suitable technology and method of planting, soil improvement and crop management. This talk has been prepared to enlighten the concerned person for vegetable production in these soils.

Characteristic of hill and forest soil including foot hill soils

(a) General characteristics :

These soils have developed on regolith (rock mass) or on colluvial deposits. Soils have very course texture with varying amounts of gravel and pebbles. Soils have very steep slopes.

(b) Drainage and water storage capacity :

Soils are shallow to medium in depth, very porous and well drained. Water retenation characteristics of these soils are very poor and total water stored in 1 meter soil depth is also very poor. Soils are well aggregated and water tables is much below the surface layer.

(c) Fertility status :

These soils are very poor in organic carbon, nitrogen

and phosphorus, poor to medium is potassium and poor in calcium, magnesium and other basic materials. The reaction of soil is slightly acidic to moderately acidic (5.6 to 6.7).

(d) Microbial population :

Microbial population is very poor. Fungus population is the dominant micro flora.

The followings are the characters of soil which are essential for cultivation of vegetable crops :

1. High amount of organic carbon :

Soil should have organic carbon more than 0.75 % to obtain a good crop of vegetable. High organic carbon Keeps soil more active for microflora and fauna.

2. Neutral in reaction :

Vegetable needs soils of neutral pH. Acid soils are not suitable for vegetable as these soils are poor in calcium and other nutrients.

3. High fertility :

Soil must contain high amount of nitrogen, phosphorus and potassium to provide sufficient nutrients.

4. Well drained soil :

Vegetable crops are very much susceptible to water logging, therefore, well drained soil is preferred. In the area of the north-east part of Bihar water logging is major

problem and in kharif vegetable is difficult to grow. But the hill and forest soils are only suitable land to meet the requirement of vegetable in the kharif season.

5. Friable and light textured soil :

Vegetable seeds need very soft seed bed to get good germination and plant establishment. Therefore, hard crusting and very heavy soils are disqualification. A friable soil with 40 to 60% sand is suitable.

6. High water storage capacity :

Vegetables are crops of high water content and they need more water to produce good yield, therefore, soil must have high water storage capacity to meet the need.

Above mentioned six soil characters are essential for good vegetable production. The hill and forest soils and foot hills soils possess only one character i.e. they are well drained and porous. This character is very important to select an area for vegetable production. Now with suitable technology and management practices these soils can be utilized for vegetable production. Following are the ways and means to improve the soil for vegetable cultivation.

A. Improvement of soil organic carbon content :

Organic matter is life of soil. Hilly soils are very poor in organic carbon. It contains 0.3% organic carbon. A

vegetable crop need soil having organic carbon more than 0.6% at least. The organic carbon contain of the soil can be improved by the following way :

1. Addition of farm yard manure.
2. Addition of leaf molds and plant residues. Plant residues can be composted with 1% nitrogen and 2% phosphate to make them more efficient fertilizer.
3. Green manuring by 'sanai'.
4. Planting grasses specially legume on strip lines.

Now special techniques should be followed in application of organic matter. These can be applied in basin or in trenches. According to spacing of crops, holes of deeper depth half to one metre should be made and organic residues with soil should be filled in prior to planting. Similarly treches should be made at a suitable interval across the slope. Depth of trenches may vary from 30 cm to 1 meter. Soil mixed with organic matter should be filled in the trenches at least 15 days prior to planting the vegetable seed or seedling. If the soil is too stony or sandy, soil from other places may be applied in such holes or trenches.

B. Removal of stones :

Stones should be screened out from the hole or trenches to keep seed bed free from stone. Soil from other places may be added to reduce stonyness.

C. Improvement of soil water storage capacity :

Addition of organic matter, leaf mold, mosses and clay help in improvment of water storage capacity of the soil. Cakes specially caster, karanj, neem and mustard are very much helpful in increasing water retension and storage capacity of the soil. Mulching with straw and wood dust and soil helps in minimising loss of soil water. Some times making 1 to 2 metre hole in seed pit and filling with loamy soil helps in capillary rise of water from lower depth to root zone.

D. Correction of soil pH

According to the need of vegetable crop soil pH should be corrected by applying powder lime. Lime helps in improvement of nutrient status microbiel population and soil softness. Therefore, prior to growing vegetables soil must be corrected for pH.

E. Improvement of nutrient status :

Soil must be tested for fertility status and fertilizer must be applied as per recommendation. Fertilizer in organomineral form is best for such soil.

F. Soil conservation :

Soil conservavion measures must be followed to protect these soils otherwise these will be washed on the steep slopes during the rains.

Thus these soils can be profitably utilized for vegetable production. There is also need to select proper vegetable crops suitable for the region. A suitable vegetable crop for such region must have deep root system, perennial in nature and they must have adoption mechanism even if there is less soil moisture.

APPROPRIATE POST HARVEST TECHNOLOGY FOR VEGETABLES

TRILOCHAN SINGH

Senior Scientist Cum Associate Prof. (Hort.)
Bihar Agril. College, Sabour,
Bhagalpur-813210.

INTRODUCTION

Fruits, starchy roots, leafy and other vegetables, herbs and mushrooms are classified as horticultural crops, of these, only starchy roots and beans provide staple food to some people. Rest are generally known as protective foods, supplying vitamins and minerals. In respects of nutrients likle ascrobic acid, they are the only or major source of supply. What is generally not recognised is that they are good producers of protein per unit area (Table-I). This is for the simple reason that the protein content is expressed on fresh weight basis. To get certain amount of protein one has to eat many times more of vegetables and fruits than pulses and cereals. Amounts of either nutrients-vitamin A, riboflavin, calcium, iron and calories produced per acre are also very high in the case of horticultural crops. Yields are exceedingly high in respect of root crops like yams and fruits such as papaya.

Present status :

The total annual production of vegetables in the world is estimated to be 370 million tonnes. India produces around 42 million tonnes vegetables annually (Annonymous, 1986). Besides domestic consumption most of our products have a ready market in the Gulf and Middle East countries. Major vegetables exported are okra, green chillies, and 'karela'. They come to 20,000 tonnes) Onion and small quantity of potato (total export 1.5-2 lakh tonnes are being exported to Sri lanka, Malaysia, Middle East and Singapore. Present levels of consumption of vegetables and fruits are below the suggested dietary allowence (Rao and Rameshwar, 1980) for a typical balanced diet (Table-2). Though no systematic survey has been done, it has been estimated that upto 40 per cent of the total production of vegetable is not available for consumption because of the losses which occur in various post harvest operations viz. handling, packaging, storage, transport and distribution in fresh form.

Processing can play a significant role in salvaging these losses. The industry at its present level of utilization at less than one per cent of the total production of vegetable in our country, is considered as insignificant. Up to 50 per cent of the market surpluses is consumed by the processing industry in some of the well developed and

advanced countries. When we review the growth of the industry as a whole we find that the industries are stagnating. Capacity utilization is below 40 per cent. The involvement of sophisticated technologies with high cost of packaging materials, and several taxes make the products costly. Hence the poor people of our country will have to choose cheaper and most appropriate post harvest technologies to conserve the most precious food like vegetables. By sophisticated technology I mean preservation practices which centre around costly packaging materials like the cans, laminates, etc. and not cheaper raw materials. Methods like freezing preservations, freeze drying, irradiations, and even clarification of juices will alwayes have limited application in the country due to high processing costs involved. These methods may serve a limited purpose for export, defence needs and for catering to tourist's demand. Instead, we may have to rely more and more on storage of fresh vegetables in zero energy cool chamber preservation of vegetables in salt solution, chemical, preservation in suitable containers, cheaper packaging with necessary modification, concentrated mixes for making appropriate dilution at home and substituting dehydration with sun drying or use of home driers and solar dehydration. In short, we have to develope an appropriate technology which is need based and economically viable under the prevailing economic conditions in the country.

New Horizones in appropriate Processing technology for vegetables:

To acheive some of the objective enumerated above viz; reducing overheads in processing, packaging and storage of vegetables, alternate technological practices have been suggested for different products. Some of the new techniques suggested have been verified on laboratory scale and others seem to be commercially feasible.

1. Storage of fresh vegetables in zero-energy cool chambers :

Cool chambers which are built with cheaper materials like bricks, sand and gunny bags or straw have been found very much effective in reducing the temperature and increasing the relative humidity of the storage condition. It has been observed that maximum and minimum temperature is reduced 8-10 C and relative humidity is increased upto 10-12% in the chambers in comparison to room. On the basis of trials it has been observed that in case of tomato, palak, bhindi, cauliflower, and parwal the shelf life is increased many folds. The storage life can further be prolonged by keeping them in perforated polythene bag (Table-3).

2. Preservation of vegetables in chemical solution :

This method involves the use of simple chemicals like glacial acetic acid and potassium metabisulphite, both of

which are quite cheap and easily available in the market. Any glass porcelain or glazed earthenware jar can be used for storing. Only fully mature vegetables should be used. Vegetables like cauliflower, peeled turnip and long melon may be cut in to suitable size, washed and drained. Peas have to be taken out of the pods. Containers should be thoroughly cleaned with water before use. Prepared vegetables can be packed in these up to the neck.

Fresh solution has to be prepared each time by mixing 50 g. of salt, one gramme of potassium metabisulphite and 12 ml of glacial acetic acid per litre of water in plastic, glass or aluminium container. Sufficient quantity of the solution should be prepared to fill the vegetable packed jars upto the brim leaving no headspace. The quantity depends on the size of vegetables pieces, shape of the containers etc. It has been observed that the quantity of solution is generally double the quantity of vegetables used except in case of pea where equal quantity of solution is taken for the seeds. After filling in the solution, put the lid on the jar and fasten it tightly. Further it is sealed air tight by stuffing up the lid gaps with cotton soaked in molten paraffins wax. The packed jars may be preferably stored in cool and dark place for more retention of colour and flavour of vegetables. The stored vegetables acquire sour or vinegar taste during

storage. In pickles and salad they can be used straightway after removing them from solution. For cooking purposes the vegetables need to be soaked in frequently changed water for 3 to 4 hours till they lose the sour taste. Freshening can be done quickly by using warm instead of cold water. Each time after removing a portion of the vegetable from the container empty spaces are filled up immediately with more solution and sealed as usual. For commercial purposes peas can be stored in wax lined cement tanks from where daily supplies can be made.

3. Dehydration of vegetables in drier :

More attractive and hygenic dehydrated vegetables can be prepared by drying them in home made drier made of galvanised iron sheet in a short period. The box of 3' x 2' x 3' is kept on iron stand and artificial heat is supplied from bottom. Vegetables are kept on trays inside the box. Commercially it may be replaced by a room made of brick and cement where heat may be supplied through steam boiler. It takes only 6-8 hours for dehydration.

4. Drying in solar drier :

Drying of vegetables can be done in solar drying which will reduce the cost of fuel and ultimately that of finished product.

5. Storage and dispensing of dehydrated peas :

In stead of card-board and laminated packing, as used by the industry at present dried peas can be packed in 400 gauge black polythene pouches which can be stacked in open top 4 gallon rectangular biscuit tins. Before finally sealing the lid with paraffin wax the tins can be evacuated and flushed with inert gas like nitrogen by providing simple valve on the lid. Rodent attack and the effect of oxygen, light and to great extent moisture can be minimised through the packaging and the canister could be used again and again.

6. Preparation and preservation of tomato crush :

Tomatoes are usually preserved as whole tomato, juice, puree paste and ketchup. The canning and pulping cost can be avoided by making simpler product by crushing the whole tomato, heating, and finally chemically preserving. After concentrating to one third quantity, 5 gram of glacial acetic acid is added per kg of the product. For every kilogram of finished product 0.4 gram of potassium metabisulphite and 0.2 gram sodium benzoate dissolved in little quantity of water are mixed. The crush is filled while hot in jars and tightly sealed. Storage is done in cool and dry places.

Development of appropriate technology as suggested above, is desirable. It will also give the industry

considerable relief in excise levies indirectly. More innovations can be brought about by the processors through their practical experience. To make all these changes possible fruit products orders have to take liberal view of these innovations.

REFERENCES :

Annonymous — 1986. Recommendations National workshop on the development of market and export of Agro-horticultural produce in the eastern and north eastern region and the role of co-operative.

Rao, S.N. and Rameshwar A. — 1980. Processing of workshops on strategies in Agriculture sector for nutritional goals : 87.

Table-1

Relative Efficiency of Vegetable Foods and
Animal Foods as suppliers of Nutrients from an Acre of Land.

Glass	Approximate amount produced per acre. Gross yield Kg/Acre	Calories 10	Protein Kg	Ca Kg	Iron g	Vitamin A I.V 10	Riboflavine g
Cereals	350	12.0	35	0.10	21.0	3.5	0.25
Pulses	250	8.6	60	0.20	20.0	2.5	1.0
Oilseeds	300	16.5	8	0.15	4.8	1.8	0.90
Milk	360	2.9	11	0.76	0.7	3.6	0.36
Animal foods	20	0.4	4	0.05	0.4	0.1	0.06
Leafy Vege.	5000-10000	24-48	200-400	12.5-25.0	750-1500	3500-7000	5.10
Root Vege.	2500-10000	50-100	100-200	1.0-2.0	30-60	50-100	1-2
Other Vege.	2500-5000	10-20	50-100	1-2	50-100	75-150	1.5-3.0
Fruits	10000-20,000	50-100	80-160	3-6	120-240	50-100	2-4
Sugar	2000	80					

Table-2

Consumption and requirement of vegetables and fruits.

PER CAPITA PER DAY

	Leafy Vegetables (g)	Other vegetables (g)	Fruits (g)
1. Actual consumption	21	71	10
2. Suggested dietary allowences	110	125	37
3. (i) Expressed as % of (ii)	19	57	27

Table-3

Self life of vegetables during storage (days)

Name of the vegetables	Room temperature	Cool Chamber
1. Tomato	6	12
2. Cauliflower	5	15
3. Palak	1	5
4. Bhindi	2	16
5. Parwal	1	17

Table-4

Constituent for 1 litre of chemical solution

for vegetable preservation

Salt	- 50 gram
Potassium metabisulphite	- 1 gram
Acetic acid	- 12 ml

HARVEST TIME INSECTICIDE RESIDUES PROBLEM ON VEGETABLE CROPS AND THEIR MANAGEMENT.

R.S. CHOUDHARY,

Deptt. of Entomology
Bihar Agricultural College,
Sabour (Bhagalpur).

Importance of vegetable production - Vegetables are the botanical fruits and it is eaten as raw or cooled. It occupies an important status in Indian economy though not at the same level as cereal and cash crops. It forms an essential component of the human diet especially in case of India and South-East Asian countries where major portion of the population constitute vegetarian. In spite of the importance of vegetables in Indian diet, it occupies only 1.20 % of the total area under cultivation and total production is about 16.0 million tonnes per year which is rather very low. It has been estimated that per capita consumption in India is only 40 gms; while for nutritious balanced vegetarion diet it should be about 400 gms.

Constraints in vegetable production :

A significant progress has been made in respect of obtaining high yielding varieties of crops. But it has been a established fact that any attempt of improvement of

agricultural production by using new cultivars with the recommended package of agronomic practices has invariably resulted in the increase in the activity and damages by insect-pests and disease. Among these two, pest problem have been reckoned as major constraint factor in successful cultivation of vegetable crops. The losses due to pests have been estimated to be 15-20 % or more depending upon favourable predisposing factors.

Startegy for pest control :

The multiplication of insect-pests under the agro-climatic condition of Indian sub-continent is very rapid due to having sub-tropical nature of climate. The pests reckoned as economic pests on vegetable crops are tissue borers as bhindi shoot and fruit borer (Earias vittella), brinjal shoot and fruit borer (Leucinodes orbonalis) sucking posts as Jassids (Amrasca sp) and thrips (Thrips tobaco). In addition, fruit fly (Dacus sp), and virus spreading insect as white fly (Bemesia tabaci) and many others are the major pests. Several methods are in hand to contain the loss by use of pesticides and non-pesticide methods. But, pesticidal chemical have proved their superiorty over non-pesticides methods due to their appreciable and quick results and by and large recognised as the cheap weapon to control the insect-pest menace. In case of vegetables, the use of pesticides

have become indispensible because of carry over the pest is in severe form than other crops.

Problem associated with pesticide use on vegetable crops :

Horticultural crops consume one third of total use of pesticides in agriculture in India. This results in the extensive spread of toxic chemicals and transport of their residue from one system to another leading to buildup in food chain.

Pesticides residue consists of remnants of pesticides or its metabolities that can be in or on a crop after its application. Vegetables make bulk of Indian diet and their conatmination with pesticides residues at biocentration level may result in toxic hazards to consumers. Besides, vegetables are consumed fresh which may be carrying the toxic quantities of residues. Therefore, the growing need is to ensure safety of food and protection of environment from pesticide contamination.

Persistence and degradaction of pesticides :

There are numerous favctors contributing to the persistence and degradaction of pesticides as nature and composition of insecticides, no. of application, weather condition, and type and stage of crop growth. Ebeling (1963) reported various plant characters influencing the persistence of pesticides on crop plants.

In most of the instances, the initial deposit is higher than the tolerance limit fixed for the insecticide. By tolerance limit or maximum residue level (MRL) is meant the quantity of substance that may be absorbed by one person from his daily diet in the course of life time without coming to any harm. The insecticides require time to reach the safe limit (MRL) and this time interval is termed as waitingh period or safety intervals. The waiting period is the time to be allowed to lapse between the last tratment to the crops and its harvest.

Specifies reports on residue problems on vegetable crops :

There are various reports on residue problems on market samples and supervised field trials. In case of market samples, Lakshminarayan (1971) from Hydrabad reported that 96 samples out of 214 were of vegetables and out of these samples 25 samples contained residues more than tolerance limit (Table - 1).

Agnihotri et.al. (1974) from Delhi also reported a number of vegetables contaminated with pesticide. In a supervised field trials, Handa et. al. (1969) reported that even methyl-parathion a common insecticide translocated from flowers to bhindi fruits (Table. 2)

Table - 1

Insecticide residues in market samples-Hydrabad

Sl. No.	Materials	Analysed	No. of samples		
			With residues	Without residues	With residues above tolerance limit.
1.	Vegetables	96	64	32	25
2.	Cereals	55	20	35	20
3.	Pulses	20	4	16	4
4.	Milk	10	7	3	7
5.	Eggs	15	8	7	8
6.	Mutton & Beef	18	5	13	5

Table-2

Dose Kg. a.i./ha	Size of the fruits (cm) at the time of application	Avg. residues (ppm) (5 day)	Residues from treated flowers to marketable fruits (10 day)
0.5	1.5 - 2.5	0.65	0.11
0.75	1.5 - 2.5	0.85	0.20
0.5	3.0 - 5.0	1.36	0.23
0.75	3.0 - 5.0	2.01	0.35
			MRL Value = 1 ppm

Krishnamoorthy et. al. (1980) found 0.249 and 0.327 ppm of phorate (1.0 kg a.i. /ha) residues in bhindi fruits even after 50 days and adviced not apply phorate in case of bhindi fruits for consumption purposes. (Table - 3)

Table-3

Phorate Residues on Pea, Chillies & Bhindi fruits.

Crops	Dose Kg. a.i./ha	Days after application	Residues in (ppm)	MRL Value
Pea	1.0	65	0.28	0.5 ppm
Chillies	0.5	70	0.032	
	1.0	70	0.032	
Bhindi	0.5	50	0.249	
	1.0	50	0.327	

There are lots of works done on pesticle residues on vegetable crops. The pesticides alongwith its doses reckoned as harmful are given in Appendix - 1.

Management of pesticide contamination or vegetable crops :

It is well established fact that pesticides produce poisoning effect in biological system. Therefore, it requires a needful and careful application of the same in the open system (agro-ecosystem) to minimise the loss caused by various insect-pests as well as to eliminate the contamination hazards for adoption on large scale.

1. Use relatively safe insecticide taking into consideration of mammalian toxicity.

2. Apply effective insecticide of biodegradable nature at the economic threshold level, particularly chlorinated group as soil application and organophosphate of contact group as foliar application.

3. Avoid use of insecticide at the time of fruiting. If unavoidable, all the marketable fruits should be harvested before insecticide use.
4. Use only recommended dose of insecticides at the right time and apply the same as uniform as possible to maintain the coverage per unit area properly.
5. To pay more attention in application of selective insecticide in place of broad spectrum.
6. Reduce frequency of insecticide treatments. Insist to treat only when necessary.

7. Incorporate non-pesticidal methods of control against vegetable crop pests as timely sowing/ transplanting, resistant or tolerant varieties, use of organic manures & balanced dose of fertilizers etc.
8. Avoid the use of mixture insecticide.
9. Extend the useful life of satisfactory insecticide as long as possible.

10. Use of chemicals; in large scale campagion rather than small against key-pests.
11. Must observe waiting periods (Appendix - II)
12. Proper washing and peeling is must before cooking of vegetables.

REFERENCES :

Aghnihotri, N.P., R.S. Dewan and A.K. Dikshit	1974. Residues of insecticides in food commodities from Delhi Indian J. Ent. 36 : 160-161.
Ebeling ; W.	1963. Deposition, degradation, persistence and effectiveness of pesticides Res. Rev. 3 : 135-163.
Handa, S.K., S.S. Mishra, Y.P. Beri and R.S. Dawan.	1969 Persistence of parathion residues on fruits of bhindi. Indian J. Ent. 31 ; 372-373
Krishnamoorthy, P.N. K.K. Kumar, K. Krishnaih, V.G. Prasad and P. Lalitha	1980 Persistence of carbofuran and phorate in some vegetables. In 'Pesticides residues in the invironment in India'. Ed.C.A. Edwards, G.K. Veresh and H.R. Krueger pp. 176-178.
Lakshminarayana, V.	1971 Organochlorine insecticide residues in food stuffs. In proc. Progress and problems in Pesticides Residues Analysis pp.51-55.

Appendix - I

Insecticides recokned as hazardous on vegetable crops.

Crops	Insecticides	Dose (kg. a.i/ha)	M R L (ppm) Value
Bhindi	Aldicarab	1.0	0.2
	B H C	1.5	3.0
	Disulfoton	0.5	0.2
	Phorate	0.5	0.5
	Phosphamidan	0.5	0.2
Brinjal	Disulfoton	2.0	0.2
	Phorate	2.0	0.5
	Carbaryl	2.5	5.0
Cauliflower	Phosphamidan	0.25	o.2
	B H C	1.5	3.0
	Carbaryl	1.1	5.0
	Fenitrothion	0.53	0.3
	Phorate	1.5	0.5
Cowpea	B H C	1.5	3.0
	Phosphamidan	0.25	0.2
Pea	Aldicarb	1.5	0.2
Tomato	Phenthoate	0.5	0.2

Appendix - II

Waiting periods of important insecticides vegetable crops.

Crops	Insecticides	Dose Kg. a.i./ha	M R L value (ppm)	Waiting period days.	
1. Bhindi fruit bearing stage).	Endosulfan	0.7	2.0	2	
	Carbaryl	1.0	5.0	2-3	
	Quinalphos	0.50	0.25	7	Summer Season
	Quinalphos	0.50	0.25	12	Rainy season
	Malathion	1.0	3.0	2	
	Permethrin	0.15	0.5	4	
	Fenvalerate	0.15	0.2	7	
2. Brinjal (fruiting stage)	Carbaryl	1.0	5.0	5	
	Endosulpfan	0.7	2.0	3-4	
	Quinalphos	0.5	0.25	21	
	Monocrotophos	0.5	0.2	6-7	
	Permethrin	0.15	0.2	5	
	Fenvalerate	0.15	0.2	7	
	Carbofuran(G)	0.5	0.2	60	Safe at Harvest
	Carbofuran(G)	1.0	0.2	75	if applied at the time of planting
3. Cabbage (Head formation stage)	Endosulfan	0.7	2	5	
	Carbaryl	1.0	5	3-4	
	Quinalphos	0.5	0.25	5	
	Monocrotophos	0.5	0.2	5	
	Malathion	1.0	3.0	3	
	Permethrin	0.15	0.5	13	
	Fenvalerate	0.10	0.2	11	
	Carbofuran (G)	1.0	0.2	60	same if applied
	Phorate (G)	1.0	0.5	70	like brinjal
4. Cauliflo- wer. (Head formation stage)	Endosulfan	0.7	2.0	3	
	Carbaryl	1.0	5.0	10	
	Quinalphos	0.50	0.25	20	
	Permethrin	0.15	0.5	22	
	Fenvalerate	0.1	0.2	9	

5. Bitter-gourd (fruiting stage)	Quinalphos	0.5	0.25	7
	Endosulfan	0.7	2.0	4

Note :- Use of synthetic pyrethroid should be ristricted. If unavoidable use before fruiting with one or two application.

STUDIES ON

FLORAL BIOLOGY IN *MOMORDICA DIOICA* ROXB. EX WILLD.

K.C.MISHRA and A.K.PANDEY

Department of Botany, Bhagalpur University,
Bhagalpur - 812007

ABSTRACT

In *Momordica dioica*, the anthesis commences in male and female buds at 7:45 p.m. and 8:30 p.m. respectively. Anther dehiscence commences at 6:10 p.m. and was complete at 6:50 p.m. Stigma remains receptive upto 11 hrs before and 13 hrs after anthesis.

INTRODUCTION

Momordica dioica (2n = 28) is a dioecious herbaceous perennial of family Cucurbitaceae. The plants are mainly found growing in wild conditions in the forests of Santhal Pargana and Chotanagpur region of Bihar. The green fruits are used as vegetable and are available from July to October. The fruits are very nutritious (Annonymous, 1962). A perusal of literature reveals that although some work has been done on floral biology of *Momordica charantia* (Agarwal *et.al.* 1950) and *Momordica cochinchinensis* (Vijay *et. al.* 1977) but no

attention has been paid on this aspect on M. dioica. The present communication, therefore, deals with some aspects of floral biology in this wild vegetable crop.

MATERIAL AND METHODS

The plants for the present study were raised in the Botanical Garden of the Bhagalpur University from tubers/cuttings. Studies were made during the rainy season when the crop was in profuse flowering stage. The number of flowers opened daily in all the plants were recorded at 15 mnts. interval starting from the time of opening till the last bud opened for 5 days. The number of flowers dehisced daily were recorded at an interval of 10 mnts. till the end of dehiscence for 5 days. The fruit set method was adopted to study the receptivity of stigma. The bud/flower in each case was hand pollinated at different intervals and the fruit setting in each case was recorded after 15 days of pollination. The observations were calculated on percentage basis.

RESULTS AND DISCUSSION

Anthesis

Mode of anthesis:

The anthesis in male and female flowers started with indication of longitudinal cracks at the apex of the yellow

coloured corolla which widened slowly upto half length loosening the corolla which resulted into complete opening of flower bud. Just after anthesis the yellow coloured anthers in male and sticky shining stigna in female flowers were seen.

Time of anthesis:

It is evident from Table 1 that the anthesis in male commenced from 7:45 p.m. and that of female from 8:30 p.m. and continued till 8:45 p.m. and 9:00 p.m. respectively. During a cloudy weather anthesis started late and flowers remained open for a longer period during morning hours whereas during clear weather flower opened early in the evening and closed itself by 3:30 a.m. On a cloudy cool night closing of flower is delayed till 6:30 a.m.

Anthesis of M. dioica (2n = 28) thus takes place in the night where as that of M. dioica (2n = 56) and M cochinchinensis takes place in the morning hours (Vijay et al. 1977). M dioica, therefore, requires some noctoral pollinating agent for better yield. Since stigma remain receptive for 100 per cent fruit set during 13 hrs after anthesis, flowers can be hand pollinated during early morning hours.

Anther dehiscence

Mode of dehiscence:

The dehiscence started with the appearance of splits on the anther lobe resulted into covering of anthers with mass of pollen grains. The dehiscence started two hrs. before anthesis and in individual flower took about 40 mnts to complete.

Time of dehiscence:

It is clear from Table 2 that the dehiscence of anthers began 2 hrs before anthesis. It started at 6:10 p.m. and continued upto 6:50 p.m. with maximum at 6:40 p.m.

Receptivity of stigma

It is evident from Table 3 that stigma was receptive upto 12 hrs before and 17 hrs after anthesis. Starting from the time of anthesis upto 11 hrs before and 13 hrs after anthesis 100% fruit set was observed.

ACNOWLEDGEMENT

Authors are grateful to Prof.K.S. Bilgrami, Head Department of Botany, Bhagalpur University, Bhagalpur for encourgements and facilities.

TABLE-1

Time and duration of anthesis in male and female flowers of Momordica dioica during September 1988.

Sl.No	Date of observation	Percentage of flowers opened at different intervals									Weather remarks	Temp (C)		RH (%)	
		Male						Female							
		7.30 P.M.	7.45 P.M.	8.00 P.M.	8.15 P.M.	8.30 P.M.	8.45 P.M.	8.30 P.M.	8.45 P.M.	9.00 P.M.		Max.	Min.	7 AM	2 PM
1.	14.9.88			37	63			31	69		1.0 mm rainy afternoon	31.5	25.5	94	77
2.	15.9.88			42	58			26	74		2.6 mm rainy day	32.5	25.1	89	87
3.	16.9.88			27	41	32		17	83		Cloudy 0.6mm	29.8	25.0	95	85
4.	17.9.88	13	22	23	22	20		15	25	60	0.6 mm Clear day	29.7	24	94	68
5.	18.9.88				64	36		21	79		Clear day	31.9	25.0	92	60

Table-2

Time and duration of dehiscence in *Momordica dioica* during September 1988.

Sl.No	Date of observation	Percentage of anthers dehised at different hours					
		6.10 P.M.	6.20 P.M.	6.30 P.M.	6.40 P.M.	6.50 P.M.	7.00 P.M.
1.	14.9.88	0	5	27	33	35	0
2.	15.9.88	0	0	28	35	37	0
3.	16.9.88	5	15	42	38	0	0
4.	17.9.88	10	17	20	32	21	0
5.	18.9.88	0	0	37	53	10	0

Table-3

Receptivity of stigma in M. dioica (2n=28) during September 1988.

Sl. No.	Date and time of pollination		Stigma age	No. of flowers pollinated	No. of fruit set	Percentage of fruit set
	Date	Time				
1.	14.9.88	12.45AM	17hrs a.a	4	1	25
2.	15.9.88	9.00AM	13hrs a.a	19	19	100
3.	16.9.88	10.00AM	14hrs a.a	32	32	100
4.	17.9.88	7.55AM	12hrs a.a	22	22	100
5.	18.9.88	2.00AM	6hrs a.a	11	11	100
6.	21.9.88	11.00PM	3hrs a.a	10	10	100
7.	22.9.88	8.00PM	at the time of anthesis	7	7	100
8.	23.9.88	7.00PM	1 hrs b.a	5	5	100
9.	24.9.88	6.00PM	2 hrs b.a	6	6	100
10.	25.9.88	5.00PM	3 hrs b.a	4	4	100
11.	26.9.88	2.00PM	6 hrs b.a	9	9	100
12.	27.9.88	11.00AM	9 hrs b.a	4	4	100
13.	28.9.88	10.00AM	10hrs b.a	3	3	100
14.	29.9.88	9.00AM	11hrs b.a	3	3	100
15.	30.9.88	8.00AM	12hrs b.a	4	1	25

a.a = after anthesis b.a = before anthesis.

REFERENCES

Agarwal, J.S., A.M. Khanna and S.P. Singh — 1957. Studies in floral biology and breeding of *Momordica charantia* L. Indian j. Hort. 14: 42-46.

Annonymous — 1962. *Wealth of India*. Vol v., CSIR, New Delhi.

Vijay, O.P., S.H.Jalikop and Prem Nath — 1977. Studies on floral biology in Kakrol (*Momordica cochinchinensis*). *Indian J. Hort*. 34: 284-288.

HERMAPHRODITE FLOWERS IN *MOMORDICA DIOICA*

KISHORE CHANDRA MISHRA and A.K. SHRIVASTAVA *

Krishna Chandra Mishra Research Institute
of Wild Vegetale crops
Bandanwar, 814 147, Godda, Bihar

Genus *Momordica* of family Cucurbitaceae includes 60 species of which 7 species are found in India (1,3). The genus displays a variety of sex forms (8). Species of *Momordica* are either dioecious or monoecious we report the hermaphrodite flowers in this genus for the first time.

The somatic chromosome number of natural tetraploid is found to be 56 (8). It is a dioecious tropical herbaceous perennial having tuberous root (5). Its aerial part dies during the winter and again sprouts from the underground part during the spring. It is found growing naturally in Meghalaya, Darjeeling and Nadia districts of West Bengal. The present collection growing in our experimental garden at Bandanwar, (4) is raised from tuber collected from Nadia district.

From the year 1985-87 all the plants were dioecious. In April 1988 all the female plants had pistillate flowers

* University Department of Botany, Bhagalpur University, Bhagalpur 812007

initially. During June 1988 hermaphrodite flowers appeared in the female plants. Before and after this period no hermaphrodite flower appeared on the plants Male plants were completely deviod of pistillate or hermaphrodite flowers. Hermaphrodite flowers were larger in comparision to either staminate or pistillate flowers. It has bigger sepals, petals and overy with longitudinal depressions.

A few hermaphrodite flowers were bagged before anthesis; such flowers were pollinated by its own pollens and again bagged. The fruits developed to about two cm diameter and then became yellow and finally red in seven days. Further development was restricted. On examination, no seed was found. The male sex of the hermaphrodite flowers were thus found to be self sterile, however, it stimulates fruit development. The hermaphrodite flowers when pollinated with pollens of another male flower developed fruits with seeds.

This system prevents or deters inbreeding and such system has evolved by natural selection because inbreeding is usually disadvantageous to wild species as it frequently leads to a reduction in vigour and other undesirable characteristics which weaken the stock (2)

The sex expression of plants is strongly influenced by environment viz high temperature and dry weather (6) the

conditions of our place during June remains (42) and dry as well. The occasional appearance of bisexual flowers in dioecious female has been previously reported by Westergaard (6), who has termed it as subgynoecious. The occasional occurrence of heraphrodite flowers reveals evolutionary trend in this species. This dioecious species is not far removed from its bisexual ancester. incomplete flowers are generally considered to have been derived from complete flowers. Because of self sterility; in course of evolution the male and female parts separated widely from each other and appeared as separate plants, thus giving rise to dioecism. According to Westergaard (6) it is possible to follow both the evolution of dioecism from hermaphrodite and the reverse process.

Further experiments is under progress to induce self compatibility by mutation (7).

REFERENCES

C. Jeffery : Kew Bulletin, 34(4), 789-809, 1980.

C. North : Plant Breeding and Genetics in Horticulture, 1979, p55, Mac Millan Press Ltd., London.

H.L. Chakravarty : Fasicles of Flora of India, 1982, p67,Botanical Survey of India, PO Botanical Gardens, Howrah 71103 (India).

K.C. Mishra and R.P.Sahu : Indian Hort 28 (3), 5-6, 1983.

M.K. Sadhu and Udayan Chakrabarty : Indian Hort 25 (3), 5, 1980.

M. Westergaard : Adv. in Gent IX, 217-273, 1959.

O. Mayo : The Theory of Pant Breeding, 1980, p 10 Clarendon Press Oxford.

R.P. Roy : Cytological Investigation in Cucurbitaceae PL480 Final Technical Report, 1972, p.28, Patna University.

Theodore Delveryas : Plant diversification, 1968, p 102 amerid Publishing Co Pvt Ltd, N-88, Cannought Circus, New Delhi-1.

VEGETABLES - MEDICINAL IMPORTANCE

J.V.V. DOGRA

Department of Botany
Bhagalpur University, Bhagalpur 812007

"Vegetables are the edible parts of many herbaceous plant raw or cooked chiefly when served with an entree or before dessert."

In our diet the vegetables are very essential. The type of vegetables varies according to the season.

The vegetables are usually taken for taste, vitamins, minerals etc. We are not well acquainted with their medicinal values. The vegetables which we consume contain a number of medicinal properties of known or unknown nature. We also do not know the diseases which are gradually developing internally unless and untill the symptoms appear. Many diseases are cured automatically with immunity or by the vegetables (Herbal drugs) which we consume daily. If the details of the main constituents of vegetables and medicinal properties are known to common man, he may cure some of the diseases by changing the quality and quantity of vegetables in the diet. Moreover, the drugs of herbal origin, it is said, are free from any side effect.

Let us have a look at some of the vegetables and their medicinal importance.

(1) Luffa cylindrica: Sponge gourd/Nenua

There are a number of reports about the use of this plant in traditional medicine. The seeds are said to be purgative and inducing vomiting. The tender fruits stimulate the flow of urine. The seed oil has been used in skin diseases. The seed extract has been shown to be anticancerous specially tested against Schwartz leukemia in transplanted tumours.

The plant contains amyrin and a saponin which on hydrolysis yields oleanolic acid, gypsogenin and gypsogenin acetate. The anticarcinogenic activity may be due to oleanolic acid.

(2) Luffa echinata: Kukarlata

The climber is antihelmintic and purgative. It is very useful in jaundice and pthisis. Some of the jaundice patients were given a drop of fruit squeeze through nostril. There was considerable reduction in the bilirubin level. The plant contains an alkaloid which showed hypotensive action. The fruits have been used in chronic bronchitis and various lung complaints.

The plant contains saponin eleterin and epicucurbitacin B. The saponin on hydrolysis yielded gypsogenin.

(3) Lycopersicum esculentum: Tomato.

The fruits are said to be promoter of gastric juice. The fruits contain 4-2 mg/100 gram oxalic acid. Due to oxalic acid people feel that it may cause stone formation but there is no concrete evidence regarding tomato eating and stone formation. The fruit extract showed fall in the blood pressure in dogs. The leaf extract showed mild anaesthetic activity. It was also reported to be a depressant of central nervous ststem. It is highly antimicrobial and antifungal.

The fruit contains 7 types of carotenoids.

(4) Moringa oleifera: Sahjan/Sojana.

Informations are available regarding use of 'Sahjan' in traditional medicines. The roots are said to be abortifacient, cardiotonic, useful in rheumatism and paralysis. Santhals use it in snake bite and in female sterility. The fruits are recomended in liver and spleen diseases. The seeds are useful in venereal diseases. The etherial extract showed anticancer activity against human epidermoid carcinoma. The extract is highly active against S. aureus, S. Suletilis and E. coli. It also showed antifungal and antiviral activities.

The plant contains sitosterone and is a rich source of vitamin C.

(5) Momordica charantia: Karela.

The fruits have been used in gouts, rheumatism, spleem and liver disorders. The fruit juice with sugar is useful in dysamenorrhoea. The use of fruits in diabetes is known since long. The hypoglycemic activity have been noted in normally and alloxan induced animals. The long, oblong and pale green varieties gave better results than the smaller green ones. The fruit contains a nitrogenous compound called charantin, which showed hypoglycemic activity in normal fasting rabbits. The fruits and seeds contain a polypeptide similar to bovine insuline.

The extract was also noted to be highly antibacterial, antifungal and antihelmintic.

(6) Musa paradisiaca: Banana/Kela.

The roots and stems are said to be effective in blood and veneral diseases. The root exact is also antihelmintic. The unripe fruits are useful in gastric ulcers. The flowers showed hypoglycemic activity in mice. The sap of the plant is effective in epilepsy, hysteria and diarrhoea. The flowers produced in January are said to be more effective.

(7) Pisum sativum: Pea/Matar.

It has been used as antifertility agent. The oil from ripened seed has been shown to affect the fertility. In rats the oil has been demonstrated to antagonise the effect of

progesterone. The active component was recognised to be a hydroxy quinone. This compound is said to be a depressant of Central Nervous System also shows hypotensive activity.

Phaseolu vulgaris: French bean.

Pods are diuretic & may be used in kidney and heart ailments. The cabbage leaves were shown to be very effective in peptic ulcers.

It is very difficult to discuss the medicinal properties of each and every vegetable which we consume, within this short time. Thus we see that the vegetables which we are consuming daily in our diet, not only give weight to our belly but also help to cure a number of diseases which we do not know even.

CYTOGENETIC INVESTIGATIONS OF MOMORDICA SPECIES (CUCURBITACEAE)

U.C. JHA and K.C. MISHRA

K.C.Mishra Research Institute of Wild Vegetable Crops, Bandanwar, Godda. Bihar

Four species of the genus Momordica have been cytogenetically investigated. Momordica charantia is annual, monoecious and cultivated taxon bearing vegetable fruits. M. balasamina is a wild, monoecious weak climber and used as indigenous medicine. Somatic studies were made and scored 2n=22 chromosomes in both the species. Meiotic studies revealed by the presence of 11 bivalents as well as normal separation of chromosomes during anaphase - I and II. M. dioica is a perennial, semi wild and dioecious species showed 2n=28 somatic count. The fruits of this species are used in vegetables and medicine. Meiotic study of M. dioica revealed by the presence of 14 ring and rod bivalents and normal separation of chromosomes. Polyploid was induced in this case with view to increase their better yield and qualities. This cytotype produces fruits of bigger size and fruiting period also increased beyond the season. Cytological investigations showed 2n = 56 chromosomes in mitotic metaphase and presence

of bivalents and quadrivalents in meiosis. Artificial triploids were raised in this species by the crosses between diploid and colchiploid cytotypes and their reciprocal. Meiotic character in triploids revealed by the presence of univalents, bivalents and trivalents and irregular distribution of chromossomes during anaphase. This led to the formation of diads, triads, pentads and other irregularities. This cytotypes could not produced fruits. Fruit setting was also failed when pollen grain of such taxon dusted on the female flowers of diploids and colchiploids. M. cochinchinensis is a wild, rhizomatous, dioecious and strong climber. It is endemic in distribution and restricted only in Assam forest. This sp;ecies produces fruits of about 1 kg. of weight each and hence, it can be domesticated for vegetable purposes. It has great medicinal values and reported to be tumerostatic also. Mitotic study of this species showed 2n = 28 chromosomes and characterised by the persence of one pair of chromosomes having secondary constriction. It indicates their later origin.

FUTURE PROSPECTS OF VEGETABLE CROP IMPROVEMENT THROUGH TISSUE CULTURE

A. K. PANDEY

Department of Botany
Bhagalpur University, Bhagalpur 812007

INTRODUCTION

Plant tissue culture is used as a blanket term for protoplast, cell, tissue and organ culture under aseptic conditions. An important contribution made through this technique is the revelation of the unique capacity of plant cells, called cellular totipotency. Thus, all living cells in a plant body, irrespective of their ploidy level and the form of specialization, can potentially give rise to whole plants. Tissue culture has become an invaluable aid in the field of experimental botany. It allows us to study basic problems related to growth and differentiation under highly reproducible conditions (Bhojwani and Rajdan, 1983). Plant tissue culture has emerged as a versatile research procedure and a significant commercial practice (Murashige,1980). It has acquired many practical applications in agriculture and horticulture.

Although considerable amount of tissue culture work has been done on economically important crops, not much attention has been paid on vegetable crops (Murashige, 1980; Bhojwani

and Rajdan, 1983; Ammirato et al. 1984). The present paper is intended to review the work done on various aspects of tissue culture in vegetable crops and to highlight future prospects of these techniques in vegetable crop Improvement.

Future Prospects

Development in cell culture technology provides several new avenues for vegetable crop improvement which are detailed below:-

Rapid clonal propagation:

Tissue culture has found its best commercial application in production of cloned plants at a very high rate as compared to conventional methods. It is invaluable particularly for initially building up of propagation stocks of elite clones/individual plants which are otherwise difficult to multiply. At present, more than 100 private laboratories are employing tissue culture for mass scale propagation and more than 300 plant species have been demonstrated to clonally propagatable through tissue culture (Murashige, 1980).

Production of genetically variable plants:

Cells in culture offer a good system for inducing variation and regenerating pure mutant types. Variant producing capacity of cell culture can be augmented to a

great extent by employing physical and chemical mutagens. From cell cultures, a few superior cultivars have already been produced in sugarcane, which are high yielding/drought resistant and temperature tolerant. Grout and Crisp (1980) reported that the propagation of cauliflower by adventitious meristems on the roots resulted in some phenotypic variants. Such meristems arise by proliferation of somatic cells on the root surface.

Regeneration of plants from long term cultures may be useful for recovery of variants or for cloning (Sharp et. al. 1982). Chromosomally stable cell suspensions cultures are important to generate new variants to be integrated into a breeding programme. In this respect, mutagenesis or somaclonal variation could be explored to identify novel variants. Alternatively, plant regeneration can be used to clonally propagate certain genotypes e.g. hybrid tomato varieties used for green house production could be cloned using shoot tip propagation. Similarly, male sterile parent plants used for hybrid seed production could be propagated in vitro.

Production of haploids:

Anther culture has got importance because of its implications in the speeding up of homozygosity and in the analysis of genetic combinations. The totipotent nature of

some of the deficiencies in the more popular varieties, e.g. Russet Burbank. Thus, there is an excellent potential for *in vitro* techniques to make a significant contribution to the improvement of the potato.

Anther derived haploids and homozygous diploids have been used for crop improvement e.g. tobacco, henbane et. Unlike other Sonanaceous taxa, the cultivated potato has not responded well to anther culture. The factor which influences most the success of anther culture in potato is the genotype of the donor plant because it has been noted that some potato cultivars respond more readily in anther culture than others (Wenzel and Uhrig, 1981). One of the major difficulties associated with anther culture of potato is the production of plants with more than the haploid number of chromosomes (Jacobsen and Sopory, 1978). Isolated pollen cultures has been attempted for both dihaploid clones (Sopory, 1977) and a tetraploid cultivar of Solanum tuberousum (Weatherland and Henshaw, 1979) but regeneration beyond embryo formation has not been successful.

In tomato, Sharp et al. (1972) were the first to report successful cultivation of isolated tomato pollen cells by nurse culture. No report was made of shoot regneration, but haploid callus colonies were obtained. *Cappadocia and Sree Ramulu* (1980) also observed globular embryos from cultured

anthers of L. esculentum x L. peruvianum hybrids which developed upto 32 cell stage.

Production of pathogen free and disease resistant plants:

Plants traditionally being vegetatively propagated are systemically infected with viruses and other pathogens which greatly reduce yield and /or quality of the marketed commodity. By employing shoot meristem culture the SPF plants or "clean stocks" have been recovered from diseased plants in a number of cases (sugarcane, potato, citrus etc.). Murashige (1980) observed that yield increases upto 30% when virus infected plants were replaced by SPF plants. Production of disease resistant plants is one of the most useful applications of tissue culture in crop improvement. Behnke (1979, 1980) using cultures of dihaploid potatoes has been able to select variant lines (and plants) resistant to toxic filtrates of Phytophthora infestans. By using pathotoxins in the media, it has been possible to create Alternaria resistant potato.

Utilizing callus cultures of tomato, potato, and other vegetable crops, Scientists may be able to study a number of aspects viz., physiology (from respiration to plant pathogen interactions). This technology can also be applied to breeding for diseases resistance.

Germplasm preservation:

Germplasm preservation of vegetable crops of diverse geneotypes is necessary because genetic characteristics remain available for developing new varieties, even in the distant future. With the increasing loss of genetic variability due to human population pressures and loss of habitat, the preservation of unique genetic material becomes more and more critical. Long term storage by cell culture methods will help to provide for the needs of vegetable breeders in the future. For some species seeds provide a method of germplasm preservation, whereas there are other species, particulary heterozygous hybrids, which must be propagated vegetatively. It is in this context that "Tissue Banks" have a significant role to play. There can be two approaches to achieve the aforesaid aim: (a) by freeze preservation of shoot meristem tips, certain other organs and even tissues which have been found fairly genetically stable, without losing regenerative potentiality in long term cultures; and (b) by establishing continuous long term cultures. Such systems will not only save space requirements and maintenance cost, but also prevent destruction of plants by disease/ natural calamities. Successful freeze preservation of shoot mersitems have been achieved in tomato (Grout et al., 1978).

If the representative plants of some endangered species have gone too old and because of senescence could not be propagated by conventional methods, the shoot apices of the same can be rejuvenated in vitro. In the recent years,rapid advances in the application of tissue culture techniques to the problems of plant genetic conservation have been made e.g. potato, cassava etc. (Wickins and Dodds, 1982; Withers, 1982).

In crops e.g. Potato, yam (Dioscorea) where tubers are used as propagules, microtubers can be generated from the preserved stocks. This would provide inexpensive propagules that can be readily available and provide an alternative source of planting material. Farmers may not need to reserve a goodly part of their harvest to use as setts the next year. Suspension cultures can be established and somatic embryos grown from them raises the possibility of large scale cloanal propagation for the future. However, one must be absolutely ceratin of the genetic fidelity of the regenerates. Carrot cultures that were subcultured frequently and during the long phase of growth retained their genetic integrity (Krikorian, 1982). More research is needed to elucidate the conditions for clonal fidelity.

Production of novel hybrids:

Protoplast renegeration would offer a means of genetically modifying single cells and recovering complete

plants. Protoplasts of two species could be fused to create novel hybrids. Several interspecies combinations would be useful in breeding programmes. Most wild species contain characteristic that would be useful if integrated into cultivated vegetables e.g. salt tolerance in Lycopersicon cheesmanii or cold resistantce in L. hirsutum.

Protoplast isolation, culture and plantlet regeneration have been achieved for numerous tetraploid cultivars of potato and some related wild species Shepard and Totten (1977) were first to report the regeneration of potato plantlets from protoplasts, using the tetraploid cv. Russet Burbank.

Exchange of germplasm:

Cell culture technology will also ease the difficulties involved in the International exchange of germplasm, since culture plants can reasonably be assured of freedom of pathogens and pests.

Production of useful compounds:

Production of useful compounds such as natural insecticide- 2-tridecanone produced by Lycopersican hirsutum through suspension cultures would be of immense economic utility (William et al., 1980).

REFERENCES

Ammirato, P.V., 1974. The effects of abcisic acid on the development of somatic embryos from cells of caraway (Carum carvi L.). Bot. Gaz. 135 :328-337.

Behnke, M., 1979.Selection of Potato callus for resistance to culture filtrates of Phytophthora infestans and regeneration of resistant plants. Theor. Appl. Genet. 55 : 69-71.

Behnke, M., 1980a. General resistance to late blight of Solanum tuberosum plants regenerated from callus resistant to culture filtrates of Phytophthora infes tans. Theor. Appl. Genet. 56 : 151-152.

Behnke, M., 1980b. Selection of diploid Potato callus for resistance to the culture filtrate of Fusarium oxysporum. Z. Planzenzcicht 85 : 254-258.

Bhojwani, S.S. and M.K. Rajdan, 1983. Plant Tissue culture. Theory and Practice, Elsevier.

Cappadocia, M. and Sree Ramlu K. 1980. Plant regeneration from in vitro cultures of anthers and stem internodes in an interspecific hybrid, Lycopersicon esculentum L. Peruvianum Mill. and cytogenic analysis of the regenerated plants. Plant Sci. Lett. 20 : 157-166.

Grout, B.W.W. and Henshaw, G.G., 1978. Freeze preservation of potato shoot tip cultures. Ann. Bot. 42 : 1227-1229.

Grout, B.W.W. and Crisp P., 1980. The origin and nature of shoots propagated from cauliflower roots. J.Horticulture, Sci. 55 : 65-70.

Jacobson, E. and Sopory, S.K., 1978. Production of monoploid embryoids and plantlets in cultured anthers of Solanum tuberosum. Plant Sci. Lett. 12 : 47-54.

Johri, B.M. 1984. Embryology of Angiosperms Springer-Verlag, Berlin.

Krikorian, A.D. 1982. Cloning higher plants from aseptically cultured tissues and cells. Bio. Rev. 57 : 151-218.

Murashige, T., 1980. Plant growth substances in commercial uses of tissue culture. T.A. Thorpe (Ed.), Frontiers of plant tissue culture 1978. Univ. of Calgary Press, Canada pp. 15-26: 518-524.

Sharp, W.R., Evans, D.A., Flick C.E. and Sommer H.E. 1982. Strategies and specifications for management of in vitro propagation. In : USDA Symposium on plant propagation. Osmund Press, New Jersey.

Sharp, W.R., R.S. and Somner H.E. 1972. The use of nurse culture in development of haploid clones of tomato. Planta 104 : 357-361.

Shepard, J.F. and Totten R.E. 1977. Mesophyll cell Protoplasts of Potato isolation, proliferation and plant regeneration. Plant Physiol. 60 : 313-316.

Sopory, S.K., 1977. Development of embryoid in isolated pollen culture of dihaploid Solanum tuberosum. Z. Planzenphysiol. 84 : 453-457.

Weatherhead, M.A. and Henshaw, G. 1979. The induction of embryo in free pollen culture of potatoes. Z. Planzenphysiol. 94 : 441-447.

Wenzel, G. Schieder, O., Prezewonzy, T, Sopory S.K. and Melchers, G. 1979. Camparison of single cell culture derived Solanum Tuberosum plants and a model for their application in breeding programmes. Theor. Appl. Genet. 55 : 49-55.

Wenzel, G. and Uhrig H. 1981. Breeding for nematode and virus resistance in Potato via anther culture. Theor. Appl, Genet. 59 : 333-340.

Wilkins, C.P. and J.H. Dodds 1983 Tissue cultuere conservation of woody species. In J.H. Dodds, ed, Tissue culture of trees.AVI Publishing Co.Inc, connecticut pp. 113-136.

Williams,E. and De Lautour, G. 1980. The use of embryo culture with transplanted nurse endosperm for the production of interspecific hybrids in pasture legemes. Bot. Gaz. 141 : 252-257,

Withers, L.A. 1982. storage of plant tissue cultures. In L.A. Withers, J.J. Williams (eds.) Crops Genetic Resources. The Conservation of Difficult Material. IUBS/IBPGR, Paris, pp 49-82.

ATOMIC ENERGY AND VEGETABLES - PRESERVATION

VINEETA KUMARI

University Department of Botany
Bhagalpur University
BHAGALPUR - 812007

ABSTRACT

Vegetables, which are essential part of human diet, begin to deteriorate soon after harvest if not preserved. It is due to physical, physiological, and phytopathological actions. These perishable foods have a high moisture content and are highly susceptible to spoilage. The application of atomic energy for preservation of seasonal vegetables is very beneficial because it improves its availability throughout the year without lossing the flavour, odour, texture and other highly desirable attributes. The application of low doses of radiation (<15 Kilorads) can arrest sprouting of potatoes and onions. Adoption of this new technology, especially for onions, could mean significant benefits to this country, which is the largest producer of the world. The safety of vegetables processed by radiation has been examined carefully both at national and international levels. Vegetables irradiated upto an average dose of 1 m rad is accepted as safe from the health angle and do not present any toxicological hazards. According to latest information about

30 countries have given clearance over 40 items of irradiated food. India has cleared application of radiation for preservation of onions, potatoes, frozen sea-foods and spices.

Preservation :

Normally human diet contains carbohydrates, protein and fats. But vitamins and some minerals are also very essential for human health. The mineral nutrients which have definite demonstrable function in the human body and metabolism are Ca, P, Fe (Shirman, 1911), except these Mg, K, S, Cl, Cu, Co, I, Mn, Zn etc. are also necessary. Except milk and eggs. vegetables are the best source of vitamins and minerals. Since the majority of the consumers do not produce vegetables themselves, these stages reflect the need for efficient vegetables production and for safe transport and storage. They include methods of plant protections and enhancement, harvesting, processing, preservation and packaging, storage and cooking. Food additives play an important role in the preservation of vegetables and in assuring its attractiveness and palatability. Preservation of vegetables deals the process of prevention of decay or spoilage of vegetables, thus allowing it to be stored in a fit condition for future use. The process used varies with the length of storage intended. Preservation increases availability of vegetables,

thus improving the nutrition of the people. Availability of seasonal vegetable throughout the year also helps in establishing prices of such vegetables. Vegetable begin to deteriorate almost immediately after harvest if not preserved due to physical, physiological and phytopathological actions. These foods have a high moisture content and are highly susceptible to spoilage.

Methods of preservation

In can be broadly divided into two categories:

1. Bacteriostatic Method:

In this method micro-organisms are unable to grow in the vegetables, e.g. in dehydration, pickling, salting, smoking, freezing etc.

2. Bactericidal Method:

In this method most of the micro organisms present in the vegetables are killed, e.g. in canning, cooking, irradiation.

One of the beneficial application of atomic energy is in preserving vegetables for extended periods. Vegetables irradiation, as this process is known, is an important milestone in food preservation methodology since the successful development of canning in the 19th century. It has unique merit over conventional methods of preservation such

as canning dehydration and salting etc., because this process does not lead to loss of flavour, odour, texture and other highly desirable attributes of fresh vegetables. Poor post harvest practices including inadequate storage and preservation facilities, as well as adverse climatic conditions, cause heavy losses in India's agricultural and marine products. Irradiation promises to offer an effective means for minimising these losses, thereby increasing the availability and stimulating exports.

Sprout Inhibition in potatoes and onions

The application of low doses of radiation (<15 Kilorads) can arrest sprouting of potatoes and onions. As a result, storage losses due to sprouting of the tubers and bulbs and their dehydration can be reduced substantially. Adoption of the new technology, especially for onion, could mean significant benefits to the country which is the largest producer of onions in the world. The development of high yielding short duration and disease resistant varieties of potatoes in recent years has led to increase production and consequently problems of storage and conservation. Chemical sprout inhibitors are difficult to apply and are not always effective. Sprout inhibiting dose of radiation is also effective in destroying tuber moth, a devastating pest of potato. Irradiation, therefore, offers a satisfactory solution to the storage problems of potatoes.

Safety of irradiated vegetables

Preservation by irradiation has been a source of controversy for some time. According to Frank & Grunewald (1970) the results of attempts to destroy aflatoxin (produced by Aspergillus flavus, a micro-organism) in food by radiation, without also affecting the food itself have shown that this is very difficult, if not impossible, because stable free radicals have been found in vegetables irradiated for the purpose of preservation. Concern has been voiced over the mutagenitic potential of these free radical remaining in vegetables (Elias, 1985). Consumption of irradiated food soon after the irradiation process has resulted in gene-mutation, chromosomes abnormalities, dominanat lethal effects and polyploidy in man (Anderson & Purchase, 1983). It is believed that these effects disappear if the food is stored for a number of days prior to consumption (Diehl, 1981). Generally, this process appears to be safe, yet it is doubtful that this form of vegetable preservation will be extensively used until the many questions regarding the process are resolved.

The safety of vegetables processed by radiation has been examined carefully both at national and international levels. On the basis of extensive wholesomeness studies with laboratory animals carried out in different countries

including India, FAO/IAEAIWHO Joint Export Committee has recommended that the food items irradiated upto an average dose of 1 M rad be accepted as safe from health angle and do not present any toxicological hazards. In fact, the doses of irradiation required for the treatment of commodities are far below this stipulated limit. The committee has further recognised radiation as a physical process like the thermal processing and not as a food additive.

According to latest information about 30 countries have given clearance over 40 items of irradiated food. Several countries have taken steps towards commercialisation of food irradiation. India has cleared application of radiation for preservation of onions, potatoes, frozen sea foods and species. Food irradiation and processing laboratory of Bhabha Atomic Research Centre is one of the foremost laboratory of such kind in the world. For over the past two decades, it has carried out research and development work relating to radiation preservation of perishable food, pariticularly those of economic importance of India. Irradiation techiques developed at this research centre have been shown to be effective for inhibition of sprouting in potatoes and onions, delayed ripening of fruits, disinfestation of grains, extention of self life of fish and meat, elimination of pathogens from frozen sea-food and microbial and insect decontamination of species.

This programme necessiated investigations for answering all possible question concerning the efficacy of the process, quality of the material and safety of irradiated food for human use. Basic studies were also needed to elucidate the spoilage factors since the major objective of the process has been on the extention of post harvest storage of different commodities in natural form.

In collaboration with grower's co-operative and other users agencies in the country, technoeconomic feasibility studies have been initiated for irradiation of certain commodities. The stage is now set for the application of radiation processing for onions, potatoes, sea-foods and spices.

References

Anderson D, and Purchase L.F.H. 1983, The mutagenicity of food. In : Conning DM, and Landsdown ABG. eds. Toxic hazards in foods. London, Croom Helm.

Bradley, G.A. 1972. Fruits and Vegetable as World sources of Vit. A and C. Hort. Science., 7: 141.

Choudhary, B. 1968. Diseases of Vegetables during transit, storage and marketing and their control. Bull. Indian. Phytopath. Soc. 4: 52-56.

Diehl, J.F. 1981. Irradiated foods - are they safe ? In: Ayres, JC, and Kirschman, JC eds. Impact of Toxicology on food processing. West port. AVI publishing Company, Ltd.,

Edney, K.L. 1983. Top fruit, In "Post harvest pathology of fruits and vegetables" (Ed: Colin Dennis), Academic Press, Harcourt Brace Javanorich Publishers, London, p. 43.

Elias, P.S. 1985, Evaluation of major food ingredients. In: Gibson, GG and Walker, R. eds. Food Toxicology - Real or Imaginary problems? London, Taylor and Francis Ltd.

Frank, H.K. and Grunewald, T. 1970. Aflatoxin control and detoxification Fd. Irradiation. 11. 15.

Goddard, M.S. and R.H. Mathews 1979. Contribution of fruits and vegetables to human nutrition.

Khanna, K.K. and Chandra, S. 1975. Some new market diseases of Vegetables. Curr. Sci. 44: 390.

Shirman 1911. Food & Nutrition Science p. 405.

Smith, M.A., Ramsey G.B. and Green, R.J. 1964. Market diseases of fruits and vegetables. V.S Deptt. Agric. Ext. Cir. 523. 19.

Tondon, R.N. 1970. Certain problems of post harvest diseases of fruits and vegetables. 7th Munokur Memorial lecture (I.I.T. Campus, Kharagpur), Indian Phytopath. 23: 1-15.

NUTRITIONAL DEFICIENEIES IN PEOPLE OF BIHAR AND NUTRITIONAL RICHNESS OF LOCAL VEGETABLES

Prof T.P. VERMA

ABSTRACT

In Bihar the food consumed by the rural people do not meet the requirement of calorie, vitamins and minerals. In case of the lowest expenditure group, the intake of almost all the foodstuff is below the desired level and there is deficiency of all important nutrients like calories, vitamin A, riboflavin, vit C and calcium. About 85% of children between 2-18 years of age do not fulfil their calorie requirements even upto 90% of the recommended allowance. Prolonged exposure to stresses of malnutrition has been recognised as an impediment to both physical and mental development.

On the other hand the state has a vast vegetabvle wealth. Our vegetables are rich in vitamins and minerals. Ignorance and poverty are the causes of our sufferings. Education is neaded to consume and grow more vegetables.

Need for revising Rinno's formula for computing Avarage Nutritional Value of vegetables has been suggested.

Nutritional Status in People of Bihar

Food and Nutrition Board in the Department of Ministry of Food and Civil Supplies, Government of India conducted a nutrition survey in Bihar in 1981-83, The findings are alarming and immediate steps should be taken to remove wide spread malnutrition in our society. The results of survey has been shown in Table 1.

Table-1

Average intakes of different nutrient in different regions of Bihar

S. No.	NUTRIENT	UNIT	North Bihar	South Bihar	Bihar Hills	Recommended allowance
1.	Calories	K.cal	1989	2333	1978	2400
2.	Proteins	g	53.3	67.8	50.9	55
3.	Fats	g	17	21	15	
4.	Calcium	mg	321	432	399	400-500
5.	Iron	mg	28	41	29	24
6.	Vitamin A (retinol)	g	144	120	673	750
7.	Riboflavin	mg	0.66	0.85	0.69	1.4
8.	Vitamin C	mg	58	34	65	40

From Table-1 it appears that there is slight calorie deficiency all over the State. There is also protein deficiency in Bihar (North) and in South Bihar Hills. There is slight calcium deficiency all over Bihar. There is severe

vitamin A deficiency all over Bihar, so also is deficiency of Riboflavin. Vitamin 'C' deficiency occurs in South Bihar Plain.

Table-2

Average intake of different nutrient in different income group of Bihar

Monthly Per Capita Expenditure (1981)

S. No.	Nutri-ents	Unit	Below Rs.50	Rs.50-75	Rs.75-100	above Rs.100	Recommended intake
1.	Calories	K.cal	1802	2079	2357	2563	2400
2.	Proteins	g	47.4	55.3	65.9	73.9	55
3.	Calcium	mg	337	317	466	562	400-500
4.	Iron	mg	27	31	36	43	24
5.	Vitamin A	g	362	275	273	194	750
6.	Riboflavin	mg	0.62	0.68	0.83	1.06	1.4
7.	Vitamin C	mg	32	58	49	48	40

From Table II it appears that calorie requirement of lower income group is not met. There is protein deficiency in lowest income group. Calcium is deficient in lowest and one above the lowest expenditure group. There is vitamin A deficiency in all groups. Riboflavin is also deficient in all groups.

Vegetables are source of food low in calories but add vitamins and minerals to the diet. Daily intake of three different forms of vegetables have been shown in Table-3.

Table-3

Division wise average daily intake of different food items

S. No.	NUTRIENT	Unit	North Bihar	South Bihar	Bihar Hills	Recommended allowance
1.	Leafy Veg	g	18	5	51	115
2.	Roots & Tubers	g	152	97	42	85
3.	Other Veg	g	62	48	46	85
			232	150	139	285

Thus consumption of leafy vegetables is low in all parts of Bihar except in Bihar Hills where lot of leaves are taken by aboriginals and tribals in famine or as scarcity food. Consumption of 'other vegetables' is also very low in all parts of Bihar. Only roots are consumed more than required in North Bihar and South Bihar.

Bihar has a vast natural resource of vegetables rich in vitamins and minerals. It is ironical that previously lots of green vegetables were consumed by us but as we are becoming more civilised their consumption and number has decreased. The vegetables introduced from other western countries became more prestegeiys for us and the government is spending more resources on the research and development of vegetables of exotic origin than in the development of indegenous vegetables. Our vegetables are more nutritional than those imported.

Several authors have developed formula for average nutritive values of vegetables. Most commonly used formula is that of Rinno. Average Nutritive Value per 100 g of vegetable according to this formula is

$$ANV = g\ \frac{protein}{5} + g\ fibre + mg\ \frac{Ca}{100} + mg\ \frac{Fe}{100} + mg\ \frac{carotene}{2} + mg\ \frac{vitC}{40}$$

When the food is consumed raw vitamin C is calculated as mg vit C/20 and if oxalic acid is present, calcium is expressed as mg Ca/200.

This formula is based on average requirement of nutrients in W. Europe. This formula should be revised for Bihar according to our requirement. We should give more importance to protein. calorlie, Vit A, riboflavin and vitamin C in computing ANV.

ANV in Table IV presents an accptable picture of the relative importance of different vegetables. The best estimate for potential production of various vegetables can be obtained by calculating the ANV per unit area per man day per unit input of capital and energy.

From Table IV it appears that local vegetables are rich source of vitamins and minerals.

Vit A deficiency can be met with taking large quantities of leafy vegetables and carrot.

Vit C deficiency can be met with use of wild vegetables 'kheksa' (275 mg/100g), sweet peppera 103 mg/100g/ and from fruits like '' Aunla' (600 mg/100g) and from guava.

Riboflavin requirements can be met by artificial vitamins, animal sources or mushrooms (0.42 mg/ 100 g)

Dry leguminous vegetables and pulses are good source of calorie and protein.

Thus nature has provided us with all protective food. Education is needed to consume more vegetables of the desired type.

Table-4

Average Nutritive value of local vegetables of Bihar

Type of product	Per 100g edible portion								
	energy k cal	protein g	fibre g	Ca mg	iron mg	carotein mg	ribo flavin mg	vit C	ANV
Leafy vegetables									
Amaranth	26	4	1.0	397	25.5	5.52	0.22	99	24.5
Cabbage	17	118	1.0	39	0.8	1.2	1.2	124	6.45
Cassava leaves	60	6.9	2.1	144	2.8	8.8	0.32	82	16.67
Poi (Basella alba)		2.8	0	200	10	7.44		87	16.16
Drumstick leaves		7.4	1.2	297	3.6	8.9		167	20.53
Fruit vegetable									
Egg plant	26	1.4	1.3	18	0.9	0.074	0.07	12	2.584
Okra (Bhindi)	31	1.9	1.2	66	1.5	0.052	0.08	13	3.367
Bitter gourd	19	1.6	0.8	20	1.8	0.126		38	4.546
Coccinia		1.2	1.6	40	1.4	0.156		16	3.471
Kheksa (M. dioica)		3.1	3	33	4.6	1.62		275	14.747
Parwal (Tricusanthes dioica)		2.0	3.0	30	1.7	0.153		29	5.428
Kakral (M. Cochinchiners)		2.61	5.93	21	2.59	1.2		247	15.33
Bankunri (S. amplexicalis)		0.7	1.6	200	1.0	0.15		15	4.77
Sprouls, bulbs, tubers etc.									
Carrot	37	0.9	1.2	18	2.2	1.89		3	4.7
Radish	3	0.7	0.8	35	0.4	0.003		12	2.243
Mushroom	37	2.7	0.9	80	1.0	0		3	2.095

CONSERVATION OF WILD VEGETABLES

SNEHESH CHANDRA SINHA

Member, World Wild Life Protection Board
Raja Ram Mohan Roy Road
Bhagalpur.

Wild vegetables plants and fruits- that is how we refer to the valuable rare flora of our jungles.

We should remember that all the vegetables wwhich are common and are in daily use in our kitchen were previously wild and after sufficient adaptation trails and researches varities have been developed to suit our taste. and climatic condition. There are still many valuable vegetables in the wild state.

'Parwal' or poiwed gourd (Tricosanthes dioica) is still in its primitive or wild form, it is propagated vegetatively by stem cuttings. Clones of parwal can be found in Diara areas of Bhagalpur. It is available only in the summer season; as soon as rains start it disappears from the market. The main reasons is that the land on which parwal grows is inundated. Our research objectives should be to grow this vegetable in the upland and throughout the year.

There are many vegetables in wild state in our forests which can also be cultivated outside the forest areas if our agricultural scientists improve its size, taste and yield.

I am trying to give some names of this type of vegetables found in local jungles and medows:-

1. Casia Tora (Chokari ka sag)

Common weed of road side or wasteland, annual herb, sometimes found in forests also under shurbs used as laxative.

2. Wild beans, barbati (Vigna unguiculata)

Grown in Rajmahal and Chandana hills by Paharias under thum cultivation on the hill slopes. I tried to grow this variety in my kitchen garden; the plants grown were healthy but gave no flowers and fruits. This variety is graded and sold at very high price in the market of Bombay. Businessmen of Dumka earn a lot by sale of the seeds of this type of barbati.

3. Wild kacchu (Colocaslia esculenta)

Both tubers and leaves are eaten by tribals. It grows in sufficient quantity in forests.

4. Ratalu (Dioscorea sp.).

This is a tuber crop and is used by the tribals and eaten after baking.

5. Wild Kundri (Solena amplexicaulis)

It is a creeper. Found in abundance in forest and hilly area. Sometimes it is also found in the vegetable market near

Bhimbandh (Munger) but they are very costly. I have tried to grow this crop in my farm but did not succeed. The creeper grows vegetatively but there was no fruiting.

6. Tilcocha (Coccinia grandis)

It is a variety of kundri found growing in a wild state. It has got a bitter taste. It is good for diabetes. Fruits are sliced dried and used after frying. Tender leaves are fried with gram powder (baisan) and served as vegetable in Mithila (Tirhut).

7. Kaihar sag

The tribals use it as vegetable in sufficient quantity. It grows in summer season only when the forest is paractically dry and very few green vegetable are found.

8. Kheksa, kakrol, kokri (Momordica dioica)

Found in abundance in forest and hill stopes-grows from bulbs, very costly because very few fine quality of fruits come in local market. K.C. Mishra has done sufficient research on it and is successful in evolving a new variety and improving its size.

9. Kalmi sag (pomea aquatica)

It grows wild in wet land. This is eaten as vegetable.

10. Punarnava (Boerhaavia diffusa)

It is used as a green leafy vegetable and is a recommended diet of the diabetic patient.

11. Noni ka sag (Portula oleracea)

The leaves and stems are valuable vegetable. The small leaf variety grows fast with help of runners. It is used in cooling the stomach.

12. Jangli chichinda (Trichosanthes cucumeria)

The plant is wild- fruits are eaten as vegetable- roots, stems, fruits are of medicinal value. The plant is also used as a laxative. It is found in abandance in Rajmahal hills and forests.

13. Bathua sag (Chenopodium album)

This is common weed of the wheat field. it is found during the winter months. Plants are rich in patassium salts, the leaves and stem are eaten as 'sag'. It is of medicinal importance for patients of high blood pressure.

14. Wild Moong

It is different from the variety used as pulse. It has more protein than the domestic variety. it is found in the forests of Munger district.

There are many more local vegetables in forsests, only good taxanomist can recognise them. Hence we find that our

forests are essential for us from many points of view. Let us preserve them, as it is, we have destroyed them much. It is true that as population grows, the need for more land for food production becomes necessary, but this should be by more intensive and scientitic cultivation and not by destriction of forests which play a vital part in ration's economy.

The Seminar is meant to focus international attention on the conservation of wild vegetable crops of Bihar and to recognise their role in rural development. The seminar appeals to the Government and scientists to accord special recognition to the forest vegetable products and regard their conservation as a matter of natural and global concern and to awaken public consciousness of the role and importance of forests and its vegetable products.