

Research Highlights

Exploration to collect wild onion and garlic

Conservation of plant genetic resources has received a large boost in recent times. There is an increasing awareness of the relevance of biological diversity and its utilization for the betterment of the human population. Particularly in the case of agricultural crops, conservation of biodiversity is an essential prerequisite for the continued production of new cultivars of crops and for the development and exploitation of hitherto novel crops.

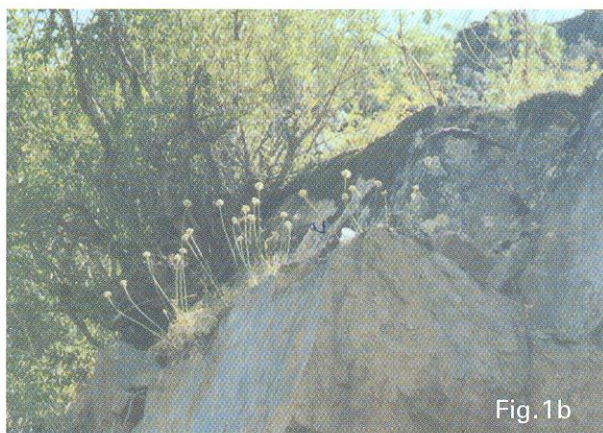


Fig.1b

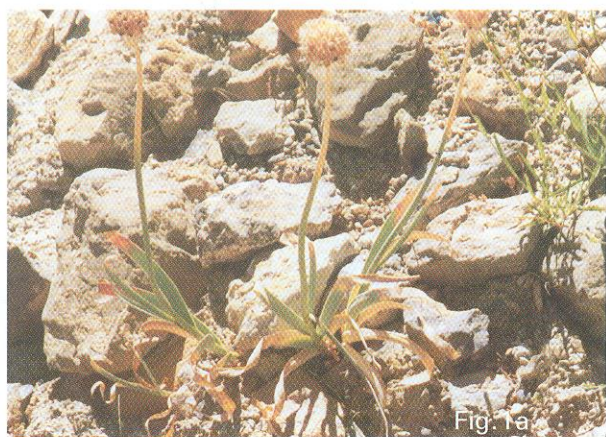


Fig.1a



Fig.1c

The genus *Allium* comprises of about 750 species and 650 more synonymous species names exist. Several important species are used as vegetables and/or spices, such as onion and shallot (*Allium cepa* L.), leek (*A. ampeloprasum* L.), garlic (*A. sativum* L.), bunching onion (*A. fistulosum* L.), chives (*A. schoenoprasum* L.) and others. To enhance the gene pool of onion and garlic, an expedition trip to the

high mountains of Lahaul & Spiti and Pangi region of Himachal Pradesh was carried out in collaboration with NBPGR, Shimla (Fig.1a-c). A total of 47 accessions comprising of onion, garlic and wild *Allium* species were collected. Variability was observed in collected wild *Allium* species for plant height, number of leaves, leaf shape, leaf colour, inflorescence shape, colour, bulb shape, scale colour and presence of leaf odour.

Micropropagation of onion via shoot multiplication and indirect organogenesis

Different genotypes of onion were successfully subjected to micro propagation *via* shoot multiplication as well as indirect organogenesis in MS based multiplication media. Axenic shoot tip explant was used for shoot multiplication experiments, whereas, seed explant was used for indirect organogenesis. Different varieties viz., B-780, Phule safed, N-53, Arka niketan (Fig.2) and N-2-4-1 were successfully induced to form multiple shoots. Callus induction and regeneration was standardized in two varieties, B-780 and Phule safed.



Fig.2

Yellow onion has potential for export



Fig.3a

India is the second largest producer of onion in the world. Prominent onion types grown are red and white. India has been traditional exporter of fresh onion mostly to neighbouring countries like Srilanka, Malaysia, Singapore, Maldives, Mauritius, Seychelles, Kuwait, Indonesia, U.A.E., Qatar, Dubai, Pakistan, Nepal and Bangladesh etc. At the same time other countries like China, Egypt, Iran, Turkey, U.S.A., Brazil and Pakistan are becoming potential competitors to India in export. Presently India is exporting dark red and light red onion varieties with globose shape. Yellow and white onions with less pungency have great demand in some European countries like U.K., Germany, France, Italy, Russia and Japan. Some of the quality standards set for these markets are: bigger bulb diameter (6-7 cm), uniform shape, size and colour and should be free from doubles and bolters. There should be proper packaging and labeling. There is wide scope for cultivation of these yellow onions in India for export purpose.

In our country intermediate long day varieties /hybrids of yellow and white onion can be grown during September - February. Therefore, more than 60 exotic hybrids were evaluated for their performance during late *kharif* season. Yellow varieties, Mercedes, Cougar and Linda vista yielded (60 to 80 t/ha) nearly double the Indian varieties like Arka pitambar and Phule suwarna during late *kharif* season. Their performance was equally good in farmers field also (Fig.3a-b). These hybrids meet all the requirements for export in European markets. But storage life of most of the exotic hybrids/ varieties was low due to more water content and less total soluble solids. However, if properly cured Mercedes and Cougar have comparatively better storage life and could be stored up to 3 months. The European markets can be tapped for export of yellow onion by developing suitable production technology, and forward market linkages by traders and market promotion agencies.

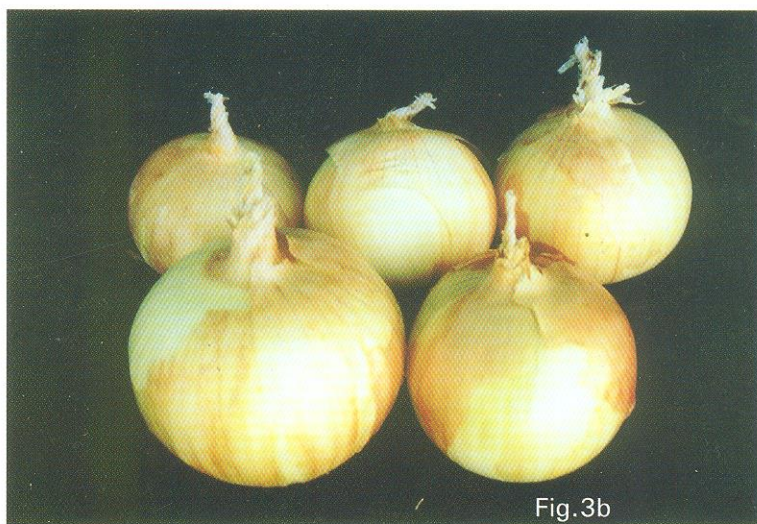


Fig.3b

Cold stored onion bridges the supply gap in off-season

Annual production of onion in India is 5.5 lakh ton. About 60 percent of produce comes from *rabi* crop that is harvested during April - May while 20% comes from *kharif* and remaining 20% from late *kharif* crop harvested in the months of October -November and February-March, respectively. This production cycle creates a gap in supply during June to October. Hence, stored onions play an important role to meet countrywide demand and export during this period. In India, onions are stored under ambient conditions, where humidity and temperature cannot be controlled. Under such conditions, the storage losses are up to 50 %, which include 20-25 % physiological weight loss, 10-12% sprouting and 10-12 % rotting. High temperature and dry air increases physiological loss of weight, whereas high temperature and high humidity leads to more rotting. Cold storage of onions considerably minimize these losses. The major draw back in cold storage is that the sprouting increases rapidly (80-90%) when stored onions are taken out and kept at room temperature. This

can be controlled by maleic hydrazide, but it is unstable in tropical conditions.

The study conducted at this research centre revealed that storing onions at 0-2°C temperature and 65-70% relative humidity could minimize the storage losses up to 5% over a period of four months. Even after four months there was no rotting and sprouting of bulbs. It was also found that exposing onions to 60-75 Gy gamma irradiation before cold storage checked the problem of sprouting during post cold storage period.

The cost of storage in cold store is comparatively higher (Rs.0.40 per kg per month) compared to modified onion storage structures. Despite this, net profit in cold storage was two to three times higher than ambient storage because of minimization of weight loss, rotting and sprouting.

Precautions such as maintenance of optimum relative humidity (65-70%), avoiding temperature fluctuations, leakage of gases, condensation of water on onion bulbs, rapid thawing and cooling, should be taken care of for successful cold storage of onion.

Indian onions are rich in selenium

Selenium is an essential trace element to humans. Organo-selenium compounds play crucial role as antioxidants in the cytosol and mitochondria. They protect DNA from oxidation by UV rays and free radicals. Among vegetables, onion and garlic are the richest source of organo-selenium compounds. The selenium concentration in plants is determined by its availability in the soil in which they grow.

Onion and garlic are grown under different climate and soil conditions in India. Therefore the selenium status in onion and garlic in India has to be characterized. This characterization of selenium rich onions will gain importance from human health point of view. To study the selenium status in onion and garlic, germplasm was collected from all over India covering the major onion growing states like Maharashtra,

Madhya Pradesh, Gujarat, Rajasthan and Karnataka, Tamil Nadu, Andhra Pradesh, Haryana and Himachal Pradesh.

Onions had very high selenium content than garlic. Onion germplasm showed great variation in selenium with different geographical areas too. It ranged from 0.48 $\mu\text{g/g}$ to 7.64 $\mu\text{g/g}$. Highest selenium concentration was observed in onion samples from Indore region and few pockets of Satara district in Maharashtra. Compared to onion, selenium concentration was substantially lower in garlic with a range of 0.16 to 0.70 $\mu\text{g/g}$. A daily requirement of 60 μg and 75 μg of selenium is recommended for an adult male and female respectively. Therefore addition of more onions in daily diet will meet the daily requirement of selenium. Further, there is need for production of selenium rich onion & garlic.

Mulching reduces weed menace in onion seed crop



Fig 4a

Control plot

Onion crop exhibits greater susceptibility to weed competition than any other crop. Initial competition tends to be severe because of early growth of onions and absence of dense foliage. This leads to deterioration of seed quality as well as reduction in the seed yield considerably. Manual weed control is commonly practiced in India. But very close spacing and shallow root system and brittle hollow flower stalk makes the mechanical weed control cumbersome, labour intensive, expensive and time consuming.

Mulching is one of the practices in weed control followed in most of the commercial vegetable crops. It is very efficient, socially acceptable and eco-friendly too. Mulches can either be organic or inorganic. It reduces the weed population, conserves the soil moisture, prevents soil erosion, maintains the soil temperature and also increases the crop yield. Keeping this in view, integrated

weed management practices in onion seed crop have been initiated using different organic and synthetic mulches. The organic mulches evaluated were paddy straw, soybean husk, bajra husk and saw dust while inorganic mulches used were transparent polythene, black polythene and bicolor polythene sheets. Synthetic mulches were found more effective than organic mulches in controlling the weeds. Among the mulches, black and bicolor polythene mulches effectively reduced the weed population and recorded higher seed yield 3.55q/ha and 3.42 q/ha respectively. ■



Fig.4b

No weeds in mulching

Indian Society of Alliums (ISA) established

Onion and garlic crops now became more vibrant from domestic supply as well as from export point of view. Focused attention has been bestowed by ICAR by starting NRC for Onion and Garlic. Lot of national consultations have gone in for improvement of productivity and quality. With a view to having more cohesiveness among the researchers, traders, industrialists, processors and farmers, it was proposed to have a separate society for strengthening and development of 'Alliums'. The intricate issues of these

commodities can be discussed in an elaborate manner under the umbrella of the society in the form of symposia, seminars, workshops, brainstorming sessions, consultative meetings etc. A meeting was held under the Chairmanship of Dr. K.E. Lawande with researchers, seed growers, agribusiness specialists, and representatives from seed companies. After thorough discussion, a society called "Indian Society of Alliums" was born on 2 May 2006. The new society was formulated with the following objectives. ■

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| i) | To promote knowledge and research in onion, garlic and other allied edible Allium species and to advance the cause of onion and garlic production. |
| ii) | To encourage the development of onion and garlic cultivation and seed production based on scientific and technical knowledge. |
| iii) | To encourage close coordination among the research workers, farmers, traders, processors and seed agencies with a view to provide support for overall growth of the commodities. |
| iv) | To organize conference, symposium, seminar, brain storming session and group discussion from time to time for exchange views and publish its proceedings. |
| v) | To undertake other activities to accomplish the above aims and objectives. |

Onion seed producers meet

Success of onion production largely depends upon the genetically pure seed of a given variety. Onion being cross-pollinated, poses many problems in maintenance of purity while producing seed. Many farmers and seed growers are unaware of seed production principles, or ignore them or are unable to follow those principles due to circumstances prevailing at their level. As a result, the varieties/land races out cross and create new variables, which many not suit farmers, traders and finally consumers.

With a view to bring awareness about these aspects of onion seed production and maintaining genetic purity and quality standards, a consensus meeting of seed producers and dealers was organised on 04/04/2006 at NRCOG. Representatives and owners of seed production agencies attended the meeting. Dr. K.E. Lawande, Director presented a brief account on status of onion seed in the country and highlighted problems encountered by the



dealers. He also suggested that there should be an exclusive association of seed growers which will provide a common platform for regular discussion and interaction with research organizations, farmers' representatives, authorities from seed certification and development department and seed producers for better quality seed production, storage and distribution. A concept of 'Seed Village' was discussed at length for overcoming the main problem in maintaining isolation and genetic purity of different varieties. At this event an association of onion seed growers was formed. ■

Institute meetings

The IX SRC meeting was held on 20-22 February 2006 under the chairmanship of Dr. K.E. Lawande, Director. All the scientists presented the research achievements of their respective projects. The SRC reviewed all the research projects and offered suggestions for further strengthening of the projects.

The IX Research Advisory Committee meeting was held on 6-7 March, 2006 under the Chairmanship of Dr. M.R. Thakur, Ex- Vice Chancellor, YSUH & F, Solan. The members, Dr. V. S. Seshadri, Dr. Nazir Ahmed, Shri Suryakand Palande, Dr. K.E. Lawande, Dr. V.S.R. Krishna Prasad and all the scientists attended the meeting.

The chairman congratulated the Director and his team of scientists for organizing a National Symposium in a befitting manner. The Committee reviewed the progress in each research project and offered critical suggestions. All the members visited villages where the technology was demonstrated. The committee expressed satisfaction after seeing the fruits of NRCOG technology in the farmers' field.

The X Institute Management Committee meeting held on 10, January 2006 under the chairmanship of Dr. K. E. Lawande, Director. The committee discussed the agenda in detail and recommended accordingly.

Transfer of technology

Training In collaboration with KVK, Nandurbar a three-day training programme was organized at NRCOG, from 23-25 Feb 2006 on "Production, post harvest technology of onion and garlic" for onion growers from Nandurbar, Maharashtra. Around 50 farmers were trained on all aspects of production, protection and post harvest handling through lectures and field visits.

Exhibition NRCOG participated in agriculture & food processing exhibition at Sangamner organized by Sangamner taluka agricultural produce society and department of agriculture, Maharashtra from 12-15 January 2006 and at Chakan on 27 January 2006.

NRCOG offers training to agricultural and horticultural officers, onion growers and traders on the following aspects of onion and garlic

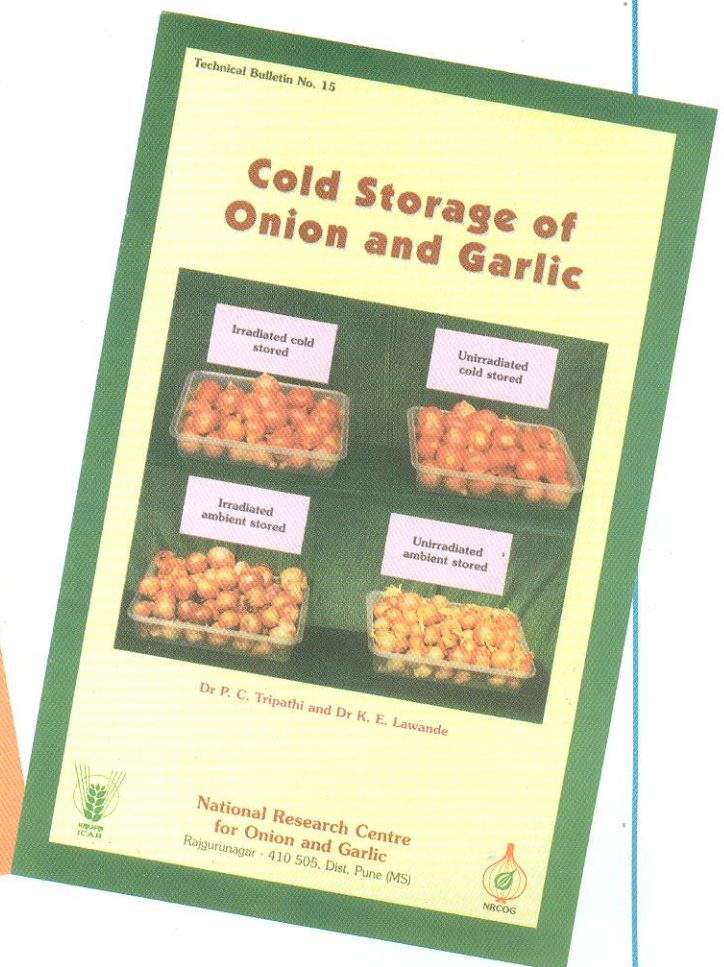
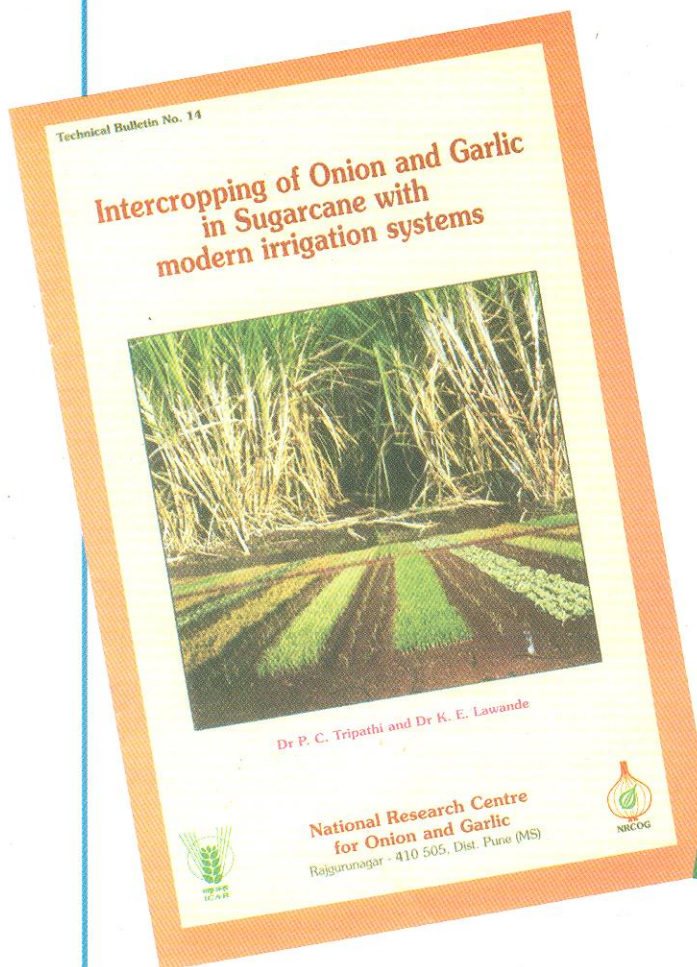
- ◆ Onion and garlic production techniques
- ◆ *Kharif* onion production technology
- ◆ Pest and disease management in onion and garlic
- ◆ Post harvest handling of onion and garlic
- ◆ Marketing and trade in onion and garlic

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