

Food Research Activities Carried out at Agricultural Research Unit, Almora

M. C. JOSHI

Agricultural Research Unit, Almora

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Abstract. A brief account of the research activities concerning food being carried out at the Agricultural Research Unit with special emphasis on the important achievements is given in a nutshell.

1. Introduction

The Agricultural Research Unit (ARU) attempts to solve the problems of logistics in high altitudes by conducting research so as to have as much food through production in the vicinity as possible. This is a new approach in defence strategy, handled primarily by the DRDO in association with other national agencies. The task is tremendous as the area of operation is very much affected by different agro-climatic parameters like rainfall pattern, sun-shine and topography of the region. Therefore, no common solution is possible for the entire Himalayan range from Ladakh to Arunachal. Therefore, regional experiments are being conducted in the four field stations in remote border areas of Auli (3143m) (Joshimath), Harsil (3143m) (Uttarkashi), Pithoragarh (1524 m) and Haldwani (330 m) at altitudes ranging from 330-3143 m. Studies carried out in these locations have generated confidence that the approach is promising and helpful for the development of the Himalayan region.

2. Some of the Important Achievements

2.1. Varietal Improvement

(a) *Brinjal* : (i) *ARU-1*—Selection from Garampani, Nainital.

The plant height is 80-100 cm with 8 to 12 primary branches. The mature fruits are yellowish in colour and their sizes vary from 22×11 cm to 32×10 cm. Individual

plant bears on an average 12 fruits each weighing 840 g to 1.5 kg with an average yield of 360 qtls/ha.

(ii) *ARU-2C*—Selection from PPC purchased from trade.

The plant height is 70-80 cm with 6 to 10 primary branches. The mature fruits are reddish black in colour and their size is about 15×10 cm. Individual plant bears on an average 24 fruits each weighing about 900 gm with an average yield of 327 qtls/ha.

(b) *Capsicum* : (i) *HC-201*—Selection from Ruby king.

The plant is about 34 cm in height. The mature dark red fruits are about 10×24 cm in size. Individual plant on an average bears 12 fruits weighing 1 kg. The yield is 280-300 qtls/ha.

(ii) *HC-202*—Selection from California wonder.

The plant which is a spreading type, is about 30 cm in height. The mature fruits are red and about 11×20 cm in size. Individual plant on an average bears 18 fruits weighing about 1.375 kg with a yield of 300-320 qtls/ha.

(c) *Chilli* : (i) *HC-1*—Selection from Kalyanpur, Kanpur.

The height is about 43 cm with 10 to 12 primary branches. The ripe fruits are blood red in colour and about 10×3.5 cm in size. The fruit matures in 167 days after sowing. The yield is about 120 qtls/ha.

(d) *Tomato* : (i) *HT-6*—Developed from the Cross HS : 102×Keekruth Ageti.

The plant height is 50-55 cm with 5 to 8 primary branches. The fruits are ready for harvest for first picking within 60 days of transplanting. The average number of fruits per plant is 81 and the yield is 550-600 qtls/ha.

(ii) *HT-8*—Pusa ruby × Sioux.

The plant height is 43-46 cm with 5 to 7 primary branches. The fruits are ready within 55-60 days of transplanting. The average number of fruits per plant is 76 and the yield is 500-550 qtls/ha.

(e) *Bittergourd* : *BWM-1*—Selection from Hawalbagh.

The length of the vine is 3-5 metres with three branches. The fruits are white and measure about 17-16 cm in size. Individual plant bears on an average 22 fruits with an average yield of 260 qtls/ha.

(f) *Cabbage* : *ARU-Glory*—Glory Enkuizon.

The heads are round and light green in colour with an average weight of 800 g. Their size is about 12×11 cm with 11 to 14 open leaves. The seedlings are ready to harvest after 90-100 days of transplanting. The yield is 236-250 qtls/ha.

Evolved varieties were included in All India Co-ordinated Vegetable Improvement Project (ICAR). Promising results were reported from different Institutions and Universities of India.

2.2. Agronomy

Different package of cultural practices were standardised for the cultivation of vegetables in different agro-climatic zones of Uttarakhand. The aspects covered were spacing, time of picking and transplanting, row plant spacing, interval of irrigation, fertilizer and manure, and weedicides. Response of soyabean variety 'Bragg' to plant population and planting geometry was also studied. The planting geometry affected the yield significantly and 1 : 1 geometry yielded higher than 1 : 4 or 1:8.

2.3. Pathology

The survey work on various diseases of vegetable crops in Uttarakhand was carried out. Diseased samples of bean, tomato, squash and bittergourd were collected and tentatively identified in the laboratory. Fungicidal trials for the control of fungal diseases in vegetable crops were carried out. 32 varieties of pea were screened for resistance to powdery mildew and rust disease. None of the cultivar was found to be resistant to these diseases. However, their intensity varied from medium to high.

Nematode infestation was observed in brinjal and onion. In onion it appears to be the first record of *Dithylenchis* (Bulb and stem nematode) in India.

2.4 Soil Science

To assess the agricultural potentials of the hilly region of Uttarakhand, a soil survey was carried out and soils of Almora, Pithoragarh, Joshimath and Uttarkashi were analysed for their physico-chemical properties. In general soils were found acidic and deficient in P_2O_5 . Soil profiles were also studied in detail at Almora, Pithoragarh and Joshimath. Experiments on the effect of bulk density on yield of the pea crop was also studied.

2.5. Bio-chemistry

Bio-chemical constituents (nutritive value) of different evolved varieties of vegetables at ARU were assessed. Bio-chemical changes associated with maturity of certain vegetables viz. tomato, bean and capsicum were also studied. On the basis of such studies picking time (days after fruit set) for tomato, bean and capsicum on Kumaon hills were standardised. Heterosis for ascorbic acid (Vitamin-C) in tomato was studied in 14 hybrids alongwith eight parents viz pusa ruby, HS-102, Keckruth Ageti, HS-101. Pisa early dwarf, S-12, Sioux and S-120. Effect of trace elements on yield and bio-chemical constituents of certain vegetables were also studied. Work related to the

enhancement of storage life of vegetables and biochemical changes during storage is in progress.

2.6. Plant Introduction

Certain new vegetables viz., *ustahak (Lal sag)*, *Karam sag*, lettuce, watermelon, celery, brussels sprout and certain new crops viz, lentil, gram, ragi and hybrid crop triticale were introduced in the Uttarakhand region.

2.7. Mushroom

Studies on the possibility of growing mushrooms in high altitude areas of Uttarakhand were made. Four different varieties of mushrooms i.e. *Agaricus bisporus*, *Pleurotus ostreatus*, *Pleurotus flabeetus* and *Pleurotus sojar kaju* were assessed for yield potentials. *Pleurotus ostreatus* variety was found highest yielding i.e. 25 kg/sq bed area for hills, upto altitude of 9,000 ft. Temperature and relative humidity, naturally present in these areas during the months from September to February were found most suitable for growing mushrooms.

2.8. Fodder Crops

Yield potentials and nutritive values of several grasses of Uttarakhand region were assessed. The maximum crude protein, mineral contents and lower values of crude fibre content was recorded in *Dactylis glamerata*, *Arundo donax*, *Apluda mutica* and *Pea pratensis* in comparison to other grasses. About thirty grasses were found most suitable for the cattle consumption. It was suggested that bailed hay from Jhansi and Babina districts of UP may be replaced by local grasses thus saving in transportation.

2.9. Maize Scheme

Under 'All India Co-ordinated Maize Improvement Project' (ICAR), a high yielding and disease resistant variety of Maize 'Auli Composite, was developed for high altitudes. Promising yield data are being reported by different research stations and universities of India.

2.10. Animal Science

A-LAYERS : (i) Four commercial strains of layers viz. Poona Pearl, Rani shaver, KEGG and Arboacre were procured and their performance for feed consumption, egg laying and mortality were evaluated. Overall performance has been observed highest in Senali followed by Rani Shaver, KEGG and Arboacre except in consumption which was high in Poona pearl.

(ii) **Housing System :** In a study carried out at Sitoli, birds (Layers) in California cages maintained an edge over birds housed in deep Litter system in egg production, egg weight and feed conversion.

(iii) *Layer Parental Stock/Hatchability*—Observations on hatchability swung from low experience (55%) to high (85%) extreme averaging at 70%. Eggs of pure line layer stock were hatched to have a permanent pool of birds for future breeding. Presently hatchery is having 650.3 weeks old pure line birds.

B - (iv) *Broiler Commercial Line*—Strains of Poona Pearl, Rani Shaver and Arvoacre were inducted and performance was observed. Birds of Poona Pearl stood first with a feed conversion ratio of 2.5 kg. Mortality was high (8%) in Arvoacre.

(v) *Broiler Parental Stock*—Two hundred parental stock of broilers (110 white rock and 90 red cornish) were inducted from CARI, Izatnagar with a view to maintain the pure line as control and also to produce strains suitable for rearing under different environmental interactions. Breeding of birds resulted in evolving and raising 1213 selected birds.

C - (vi) *Quails*—An intensive trial breeding programme was carried out with 134 quails inducted in 1980 from CARI, Izatnagar. Present number of quails are 2250 despite various constraints in the beginning. The mortality in first week touches 24%. Hatchability of quails eggs has been observed as high as 63% and as low as 54%. Birds mature in 5 weeks with body weight of 127 gm and produce between 210 and 230 eggs annually.

(vii) *Pickles*—Preservation technology had been tried in pickling the quails eggs. It has been established that pickled eggs can be kept upto a month in containers. To keep the pickled eggs for months together hermetically sealed containers/polypack pickle containers' are yet to be developed for want of advanced technology.

D - *Cattle*—Few KARAN SWISS Cross-bred cows were inducted in May '83 and some cross bred heifers were inducted from Military Farm, Pithoragarh in July '82 to observe their adaptability.