

An Oasis in the Cold Desert—Field Research Laboratory, Leh

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Abstract : Results of the research carried out in the fields of Agriculture, Animal Husbandry, Poultry farming, Pisciculture, Rabbit farming by the Field Research Laboratory, Leh has been reviewed. The aim is to develop suitable techniques for the farmers of these high altitude areas, in the respective fields, to ultimately meet the local requirements and cut down the costly transportation of these items by air/road. In addition, work has also been taken up lately in the utilisation of non-conventional sources of energy with reasonable amount of success, to conserve the existing fuel resources.

1. Introduction

Ladakh called a high altitude cold desert—is one of the most remote and rugged regions of the world. It is lying between an altitude of 2700 and 8000 metres on the western edge of the Tibetan plateau, and covers about two thirds of the State of Jammu & Kashmir. The climate is also among the most unusual and extreme in the world. Amidst snowy mountains and beyond the reach of the Monsoons that affect most of India, Ladakh receives an annual rainfall of about 10 cms. Days can be very warm in summer, over 30°C, and mild in winter but invariably cold at night upto—30°C. It is also fairly sunny—cloud free days average 325 per year.

Consequent to the visit of then Prime Minister Late Pandit Jawahar Lal Nehru to Ladakh in 1960, it was desired by him that a Research Unit be set up at Leh, for development in the fields of Agriculture and Animal Husbandry. Late professor Boshi Sen, Padma Bhushan, the then Director of Vivekananda Laboratory, Almora was entrusted with the work under the instructions of the then Prime Minister. For administrative purposes the Unit was brought under ICAR (Ministry of Food and Agriculture) and Professor Boshi Sen was appointed as Honorary Advisor.

Due to certain administrative and technical difficulties, the Unit was transferred to the Research and Development Organisation, Ministry of Defence, with effect from

July 1962, at the instance of the then Prime Minister, Late Pandit Jawahar Lal Nehru. The local Animal Husbandry Farm and the State Agriculture Farm at Ranbirpura which were under the J & K Government, were also subsequently transferred to the R & D Organisation, Ministry of Defence in January '63.

2. Objectives

The objective of Agricultural Research at Leh has been mainly to find out by introduction, selection and evaluation, the various strains of vegetables, cereals, fodder etc, best suited for this region from the point of view of early maturity, yield and quality of products.

On the Animal Husbandry side, the research has been mainly to study the performance of cross breed animals, improvement of the genetic potential of the local animals, housing of animals under extreme cold conditions and problems connected with fertility, sterility, diseases etc.

In the field of poultry, problems relating to housing and rearing the birds under extreme cold conditions without any artificial heating source, have been taken up.

3. Achievements

3.1. Agriculture

(i) *Vegetables*—Ladakh has a very short agricultural season lasting from May to September, when a few vegetables, local Wheat/Barley are grown. For vegetable cultivation a minimum of one month is required to raise the seedlings. Thus, one month of good growing season is lost in raising the seedlings before transplantation.

Field Research Laboratory has since developed a technique of raising seedlings early when the ambient temperatures are still sub zero. These seedlings are raised without using any artificial heating sources, and are ready the moment the Agricultural season opens up. This has resulted in making available the entire agricultural season for the growth and development of the vegetable crop. As a result, vegetables requiring longer duration for ripening, have been successfully raised eg. Tomato, capsicum, chillies, brinjal etc.

Vegetable Nursery Raising Technique

Nursery raising is amongst the most important operations of vegetable cultivation. In Ladakh the agricultural season commences around the month of May and ends by the end of the month of September. It should be the endeavour of every farmer to make maximum use of this limited season for cropping. To enable utilise the limited time of favourable season at his disposal for the growth of the crop, FRL has devised a specialised nursery raising technique, by which seedlings become available to the farmer as soon

as the season opens up, thus giving him a bonus of an additional 1-1/2 months.

The nursery raising in Ladakh is of following three different types :—

- (a) Trench system
- (b) In boxes under glass house
- (c) Surface nursery under polythene covers.

The earliest seedlings are obtained from the first two systems. However these seedlings can be used only by those farmers having irrigation water readily available. A majority of the farmers are dependent on snow melted water, which becomes available only by the month of May, and as such need seedlings only at that time, and for that the technique of surface nursery raising under polythene covers assumes utmost importance.

Surface Nursery Raising Under Polythene Covers

In surface nursery system, the nursery beds of suitable size i.e. 2.5m x 1.5m are made as the ground surface. The plots are manured with well-rotten farm yard manure at the rate of 20 tonnes per hectare. Over the so prepared beds, sieved soil should be spread in a thin layer of 1 cm thickness, over which a layer of well-rotten farm yard manure of 1cm thickness is also spread. The nursery bed is then slightly raked with a garden fork and levelled.

After a selection of the appropriate variety suitable for the region, sowing of healthy seed should be carried out. The sowing operations can commence by the middle of the month of March, so that by the first week of May, the seedlings become available.

Very light watering should be done, and this should be repeated only after the seeds have germinated, unless of course there has been a dry spell.

Immediately after watering, the nursery beds should be covered with transparent polythene sheets. By having a proper frame made out, it is very easy to cover them and at the same time give all the protection to the seedlings. The sheets should not touch the surface. This transparent polythene sheet should then be covered by a black polythene sheet. The transparent polythene sheet cuts out the wind factor, and with the help of the heat of the Sunlight, builds up the temperature during the day time. To conserve this heat, a black polythene sheet is used at night. However, during the first 3-5 days both the covers are used even during the day time to keep the beds warm. Once the germination starts, the black covers should be removed during the daytime to allow Sunlight, which is essential for the growth of the plants.

Even when the temperatures are otherwise unsuitable for plant growth in the open, the seedlings come up extremely well under the polythene

covers and are ready for use the moment season is open for normal agricultural activity, which is a very big advantage to the common farmer, as he is now able to grow vegetables up to maturity which hitherto was not possible.

It has thus now been possible to grow as many as 45 varieties of vegetable including green leaf vegetables, during the agricultural season. Every year, about 15 to 20 lakh seedlings are given to the local farmers at a nominal cost. The local farmers in turn, supply the produce to the local garrison which is a ready market for them. The local production of vegetables has saved an enormous amount in the transportation costs of vegetables which would otherwise have to be brought from the plains.

A stage has also now come when there is a glut of vegetables in the market. Already various methods are being adopted to preserve the hardy varieties of vegetables like potato, turnips, beetroot, cabbages, etc. for consumption during the winter months. The softer varieties of vegetables such as, cauliflower, tomatoes, peas, etc. which were hitherto being sundried, are now also being tinned fresh.

Growing of fresh vegetables during the Winters

In Ladakh normally cultivation is taken up only once in a year during the period April to September. By extensive trials we have been able to introduce double cropping in this region. It is now possible to grow all varieties of green leaf vegetables and crops like cabbage, , peas etc. under polythene covers even during the peak winter months when the temperatures go as low as—28°C. The local farmers have envisaged keen interest in these trials this year and it is expected that they would adopt the technique developed by us very soon.

The day is therefore not very far off when this remote area would be self-sufficient in fresh vegetables throughout the year and there would be no requirement of bringing these items either fresh or tinned from the plains.

(ii) *Cereals*—Several varieties of Wheat and Barley have been identified. But the major problem in the extensive cultivation of these improved varieties is that these varieties mature early and any single farmer who has taken up to the cultivation of these varieties has the problem of massive bird damage, as all the birds would concentrate on his field. Unless some sort of a legislation is passed by the local authorities and the local farmers are convinced of the benefits of growing these improved varieties over large areas in blocks, the progress on this would be slow.

Winter varieties of wheat have been cultivated for observing their behaviour pattern, production, etc. Thirty varieties of these winter wheat were sown during the month of October 80. These germinated and when they were about 6" high the winter had set in and the leaves completely dried up. The root was however alive. The crop remained in the open and was

covered occasionally by snow as and when received. During April 81 when the temperature outside started rising, the crop, the roots of which were still alive started sprouting. The growth was very luxuriant and the crop came to maturity during the middle of June 82, thus giving scope for taking up another crop of normal wheat or a quick maturing vegetable. Therefore, with the success of this practice, double cropping would be possible in Ladakh thereby improving the food situation tremendously.

(iii) *Pulses*—Pulses form an excellent source of protein. Several varieties of beans are being successfully grown. In addition, several varieties of Bengal gram (chick pea supplied by the International Crop Research Institute for semi-arid tropics (ICRISAT) have been introduced successfully. These varieties have performed extremely well in the initial trials. This is the first year of the trial and after having studied their performance for another two more seasons, we could recommend the successful varieties for field in the user conditions.

(iv) *Oil Seeds*—Three oil seed crops come up extremely well in this area. They are mustard, sunflower. At present mustard is being cultivated by most of the farmers, to the extent he can afford to spare the available land after meeting his requirement for grain crops such as, wheat and barley due to limited irrigated land available at his disposal. Sunflower is gradually gaining popularity since it has a better oil value and is easy to cultivate. As regards safflower, this is still limited to areas which are deficient in irrigation facilities.

(v) *Fodder*—Lucerne, locally known as 'ole' is the main fodder crop of this area. This grows almost wild at many places. This is a perennial crop, and with little irrigation and care, one can get good returns. Presently this crop is being harvested only once during the season due to religious taboo. As per our experience it is seen that in case this crop is cut at least three times during the season, one could get much more yield than the single cutting practice. We are in the process of educating the farmers over the advantages of multiple cutting. Most of them are getting wiser and the multiple cutting pattern is slowly but surely catching up.

Some improved high yielding varieties of lucerne such as, T-9 have been introduced very successfully. The introduction of this T-9 variety of lucerne, coupled with improved cultural practices and multiple cutting, the production of fodder in Ladakh would improve manifold, indirectly contributing to development of the dairy industry.

In addition to Lucerne, we have also been successful in the introduction of fodder maize and oats. The yield of maize has been good, while that of oats has been fair to good.

Several pasture grasses have been introduced and these are under observation.

3.2 Animal Husbandary

(i) *Diary Development*—Studies have been carried out on cross breed animals (friesian X Sahiwal and Jersey crosses). FRL has developed a housing and management system by which these animals can be reared without any artificial heating of the animal houses during extreme winter months. There has been no serious incidence of any diseases and the animals have acclimatised without any problem. The yield of the animals has been encouraging. One animal has touched a peak yield of 39.5 litres milk per day, which is commendable especially because of the fact that the animals are entirely on dry fodder as no green fodder is available locally.

Cross-breed animals have also been inducted to locations upto a height of 14500', to study their behaviour pattern and effect of altitude and extreme cold temperatures on the performance. The studies are in their initial stages but the results have been quite encouraging.

A programme is also in hand for inseminating the local cows with semen of high pedigree bulls in order to improve the genetic potential of the local cows in respect of milk production.

(ii) *Poultry Farming*—Two types of housing systems have been developed wherein the birds remain comfortable even during winter. One is the semi-underground system and the second, trench housing system. Both these housing systems are good and there is no requirement of artificial heating of the houses even during the winters when the temperatures are extremely low. The houses have been so designed as to harness the solar energy for heating during the day time. The sheds are covered with polythene sheets at night to conserve the heat.

Trials are being conducted for the selection of a suitable strain of layers as well as broilers, which would be ideally suited for this location, and at the same time be economical.

The development of poultry industry in this region has been very slow mainly due to the non-availability of feed locally and the high cost of transportation of same from the plains. Efforts are being made to develop a suitable feed mixture using locally available ingredients.

(iii) *Rabbits for Meat*—Presently the requirement of mutton and poultry meat is met by transportation from the plains either by road, (sheep/goats) during the road open season, or by air (dressed meat) during the winters when the road is closed.

The rabbits multiply rapidly and the feed conversion is also good. Trials are being taken up to evaluate their performance viz-a-viz the poultry, in terms of feed conversion per KG of live weight and the economics of issue of rabbit meat in lieu of chicken. Since the rabbits can breed locally, and

multiply rapidly, unlike the poultry where day old chicks have still to be obtained by air from the plains as hatching of eggs has not yet been possible, rabbit farming is likely to prove very successful.

We have inducted four breeds of rabbit namely, Angora, Newzealand White, Soviet Chinchilla and Grey Giant, to study their breeding pattern and programme.

(iv) *Pisciculture*—Mirror Carp variety of fish have been successfully reared and kept alive through the winters, when the temperatures go as low as -20°C and the top two feet of the fish pond gets frozen. The fish during such periods hibernate. Efforts are being made to keep the pond in an unfrozen condition by harnessing solar energy, to enable the fish to move about, feed and gain weight.

3.3 Non-Conventional Energy Resources Utilisation

(i) *Harnessing Solar Energy*—Ladakh is a region of extreme cold temperatures which go as low as -30°C . Working efficiency at such low temperatures is poor and excessive use of kerosine oil Bukharies is made, to heat such areas. The use of these bukharies is not only expensive but the resultant dehydration effect poses a health hazard.

Repair of vehicles during the winters was a problem as handling of tools was not possible and where essential repairs had to be carried out, such areas were heated with kerosine oil bukharies.

Similarly, field hospitals were experiencing a problem of accommodating patients during the winters. Keeping them indoors necessitated the use of kerosine oil Bukharies. This was posing a health hazard due to the dehydration effect.

To solve the problem, the FRL has developed, solar huts and solar repair bays wherein, polythene sheets have been made use of, to cover the roof and the sides facing the Sun. The polythene sheets were kept securely in place by means of wire meshing/camouflage netting. These have withstood the weather.

The temperature bild up inside was amazing. The difference in the inside and outside temperatures was as high as 20°C to 25°C at about 1300 hrs on a clear day. The working couditions inside were very comfortable. The repair of vehicles could be undertaken very efficiently and the patients remained comfortable throughout the day without any adverse effect on their health.

(ii) *Harnessing Wind Energy*—Leh has an appreciable wind for about 8 months of the year. The average wind velocity has been found to be around 5 Knots per hour.

A vertical axis wind mill for power generation with a capacity to generate 3 to 5 Kw power has been planned. The BHEL, Hyderabad and IIT,

Madras have under a programme sanctioned by the Department of Science and Technology, fabricated five wind mills for multilocational trials. Leh would be one of the locations.

(iii) *Photo Voltaic Pumping-cum-Lighting System*—A pumping-cum-lighting system was commissioned in Oct. 81 to light 20 tube lights and also run a 0.5 HP motor for pumping water. This system was established jointly by the Field Research Laboratory and Central Electronics Ltd. Sahibabad, New Delhi to study the efficiency of photo voltaic cells at high altitude. Due to a high number of sunny days and better intensity of sunlight, the system has been functioning very satisfactorily. At present, this system may sound uneconomical, but in the long run this system seems to be the only answer to solve the energy problems in these remote areas.

3.4 Cowdung Gas Plants

The cowdung gas plant is designed to produce fuel gas as well as manure from fresh cowdung. FRL has successfully developed the gas plant and gas stove for the high altitudes. The gas production is maximum during the period of July to October. Even during the month of December, gas production was there in small quantities. It is only during the months of January & February when the slurry is frozen that there was no possibility of any gas production. With the large-scale establishment of cowdung gas plants locally, the consumption of kerosene can be cut down to a large extent as every house-hold in Ladakh has atleast 3 or 4 animals and at the same time wood which is so precious in Ladakh and is used as fuel by some could be used for alternate [purposes. Small demonstration Units are being erected at different villages to make the farmers aware of the benefits of the cowdung plant.

4. Conclusion

Field Research Laboratory has carried out considerable research work which is not only of importance to Defence but also of national interest. The technical know-how of the developed items is passed on to the local farmers through the local Development Commissioner, Desert Development Agency and other local bodies. A stage of self-sufficiency has almost been reached in so far as vegetables are concerned. Efforts are being made to improve their yields and also provide more varieties to avoid monotony in consumption and supply. As far as Animal Husbandry and Poultry are concerned the local farmers have started envisaging keen interest and it is hoped that with the incentives being provided by the local agencies, development in this region would gain rapid momentum.

Keen interest has been shown by various local agencies for developing the use of solar energy.

The people of Ladakh are becoming very progressive and the day is not too far off when this remote area would become self-sufficient in all its food requirements and thereby contribute in a big way in the development of our nation.