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PERIWINKLE- A CONTINGENT CROP FOR BARREN AND SCANTY RAINFALL AREAS

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ABSTRACT

The plant has been cultivated for a long time, for ornamental purposes, and it is acclimatized to local conditions. Indian farmers have been looking for some better alternative crop due to gradual reduction in profitability owing to decline in productivity, increased incidence of disease and pest attack in traditional crops, contingent upon their hardy nature and higher returns, periwinkle cultivation is a better option. There is immense scope for cultivating periwinkle in barren land areas, with minimum availability of irrigation water. In India, It is drought tolerant annual, hence is cultivated under rain fed condition in barren land by small and marginal farmers of Gujarat, Rajasthan, Assam, Madhya Pradesh, Maharashtra, Andhra Pradesh, Telangana, Karnataka and Tamil Nadu. Worldwide, there is increasing demand for the alkaloids that it contains, making its cultivation profitable.

Keywords : *Periwinkle, cultivation, medicinal use, barren land.*

INTRODUCTION

Periwinkle (*Catharanthus roseus* (L) G. Don) is a perennial tropical herb and is cultivated as an ornamental and belonging to the family Apocynaceae. This is an medicinal shrubs or herbaceous plant, sprawling along the ground or standing erect to 1m (2 feet) in height, native and endemic to Madagascar where its natural habitat was almost been lost. This herb is now common worldwide as ornamental-cum-medicinal plant (Akthar Husain., 1993). It is also known as the source of chemical compounds used in the treatment of cancer. Their discovery led to one of the most important medical breakthroughs of the twentieth century. Plant species Vinca minor L., Vinca major L., (blue periwinkle), *Cantharanthus cariacetrs* L.; edible species of sea snails & ittorina littoren L, *Littorini obtusata* L.) And shell fish (Tympanostomusfuscatus) are also known by the name periwinkle. The interest in this plant

emanates due to the fact that it contains more than 120 terpenoid indole alkaloids (TIAs),several of which exhibit strong pharmacological properties. The plant has been used in traditional medicine since ages in various parts of the world (Arora et al., 2010; Paula Santos et al., 2010).

It has been catapulted into the international limelight of modern medicine owing to utilization of vincristine series of alkaloids, which can be extracted from leaves of the young plants. The alkaloids have been used extensively in the pharmaceutical industry for the treatment of various types of cancer and malignant growth. Ajmalicin is another type of alkaloid which can be extracted from the roots of same plant and have therapeutic value in controlling hypertension and capillary fragility. Pharmaceutical companies like M/s Eli Lily, USA and even M/s CIPLA from India are known to be leading organization in production and utilization of the alkaloids from periwinkle. India is one of the major producers and principal exporters of the crude drug. Mozambique, Malaysia and Madagascar are the competitors. Seven species of the genus are known from Madagascar; one is restricted to India and Sri Lanka, while one species is cultivated in China. The plant is believed to be a native of the West Indies. Catharanthus is more commonly knownas Madagascar periwinkle (Gurib-Fakim., 2006)

Europeans used the plant for minor ailments like headache to a remedy for diabetes. Some of its alkaloids are approved asantineoplastic agents to treat leukemia, Hodgkin's disease, malignant lymphomas, neuroblastoma, rhabdomyosarcoma, Wilms' tumor, and other cancers (Nayak., 2006). Its vasodilating and memory-enhancing properties have experimentally been indicated to alleviate vascular dementia and Alzheimer's disease. The plant also has antihypertensive and antispasmodic properties (Retna and Ethalsa., 2013).

1.1 Area and Production

It is naturalized in most tropical and subtropical regions being escaped from cultivation, spreading in rocky outcrops and roadsides in dry savanna, urban open spaces and in cultivated areas. In India, it is being grown in Tamil Nadu, Karnataka, Andhra Pradesh, Madhya Pradesh, Gujarat and Assam in an area of about 2000-3000 ha. Global production of root alkaloids (Ajmalicine) is to the tune of 3600 kg per year, whereas that of leaf alkaloids (Vinblastine and Vincristine) is only a few kilograms. The market value of these alkaloids, however, is in the range of several hundred million US dollars (Mishra et a., 1996).

1.3 Common names

Periwinkle is known by several names as mentioned in Table 1

Language	Name
Bengali	Gulferinghi, Nayantara
English Periwinkle	
Sanskrit	Madanah
HindiSadabahar	
Kannada	Samashana Kanagale
Tamil	Marukkalankay
Telugu	Billa Ganruru
Malayalam	Ushamalari, Vanpoo
Marathi	Sadaphul
Oriya	Ainskati

Table - 1 : Vernacular names of periwinkle in different languages

Common names of Catharathus in different countries were depicted in Table 2

Table - 2 : Some common names of Catharanthus in different countries

Sl. No.	Country	Common names
1	Bangladesh	Nayantara
2	Brazil	Boa-noite, Congorca
3	Cook islands	Tiare-tupapaku-kimo
4	Dominica	Caca poule
5	French Guiana	Pervenchede de Madagascar
6	Guatemala	Chatilla
7	Guyana	Periwinkle
8	India	Ainskati, Billaganneru, Nayantara, Nityakalyani, Periwinkle, Sadabahar, Sadaphul, Ushamanjairi
9	Jamaica	Periwinkle
10	Japan	Nichinich-so, Nichinichi-so
11	Kenya	Maua
12	Madagascar	Madagascan periwinkle
13	Mexico	Ninfa
14	Pakistan	Sada-bahar
15	Peru	Chavelita
16	Philippines	Atay-biya, Chichirica, Kantotan,Periwinkle, Tsitsirika
17	Rodrigues islands	Saponaire
18	Sri Lanka	Mini-mal, Patti-poo
19	Thailand	Phaeng phoi farang, Phang-puai-fa-rang
20	USA	Periwinkle

1.3.1 Composition

Periwinkle produces more than 100 terpenoid indole or bisindole alkaloids. Most important among these are the dimeric leaf alkaloids; Vinblastine and Vincristine and the monomeric root alkaloid "Ajmalicine". The alkaloids vindoline, catharanthine, cathenamine, strictosidine, serpentine, secologanin and leurosine have also been detected in these plants. The alkaloids are distributed in all parts of the plant in varying proportions: roots 0.7-2.6%, root bark 4.5-9.0%, stem < 0.1-0.5%, leaves 0.3-7.5%, flowers < 0.1-0.8%, fruits < 0.10.4%, seeds upto 0.2% (Krishnan, 1995).

The root contains 0.01-0.1% ajmalicine, while the leaves yield 0.001-0.002% vinblastine and 0.000002-0.005% vincristine. Factors such as genotypes, crop age, nipping tops or pruning, defloration, soil moisture regime, fertilizers application, PGRs, climatic conditions etc., influence the total alkaloid concentration in the leaves and roots.

2.0 Medicinal uses

Vinblastin, vincristin, leurosidine and leurosine are oncolyric alkaloids are effective against leukaemia. Vinblastin sulphate is used particularly to treat Hodgkin's disease beside lymphosarcoma, choriocarcinoma, neuroblastoma, and carcinoma of breast, lung and other organs, in acute and chronic leukaemia. Vincristin sulphate arrest mitosis in metaphase and is very effective for the treatment of acute leukaemia in children and lyphocytic leukaemias. It is used against Hodgkin's disease, Wilm's tumor, neuroblastoma, rhabdosarcoma and reticulum cell sarcoma (Béni et al., 2012) Chloroform fraction of crude drug showed significant and sustained hypotensive action and sedative and tranquilizing properties similar but more marked than total alkaloids of *Rauvolfia serpentina*. The alkaloid also causes relaxant and antispasmodic effect on smooth muscles of the intestine and uterus, and direct myocardiac and central nervous system depression (Dev et al., 2020; Morrone et al., 2011).

2.1 Mode of action of Vincristine and Vinblastin

Vincristine (brand name, Oncovin), is also known as leurocristine. VCR is a Vinca (*Catharanthus roseus*) alkaloid and hence its name. In most commercial preparations, VCR appears as a colourless fluid (Verma et al., 2017). It is a mitotic inhibitor, and is extensively used in cancer chemotherapy. Vincristine was approved by the United States Food and Drug Administration (FDA) in July 1963 (Farnsworth,1988) as

Oncovin.

Vincristine binds to tubulin dimer, which is a structural protein, inhibiting assembly of micro tubule structures. Disruption of the microtubules arrests mitosis in metaphase stage of the cell cycle (Sorger., 1997). The Catharanthus alkaloids affect all rapidly dividing cell types including cancer cells, intestinal epithelium and bone marrow. Both VCR and VLB are active at submicromolar concentrations ranging from 10 nM upto 1 μM. These drugs bind to the growing ends of microtubules resulting in an "end-capping" or the "poisoning"effect. It has also been noticed that at higher concentrations (> 10 μM), these compounds also cause tubulin aggregation, which results in the formation of tubulin paracrystals (Arora et al., 2010; Verma et al., 2017).

Vinblastine is the official generic name for the alkaloid formerly known as vincaleukoblastine. It is a colourless compound. The sulphate derivative (VLB), which is used in the clinic, is a white to slightly yellow, hygroscopic crystalline compound that is soluble in water and methanol. It is an anti-mitotic drug widely used medically to treat different kinds of cancers, e.g. breast cancer,non-small cell lung cancer, head and neck cancer, Hodgkin's lymphoma and testicular cancer. Vinblastine was first isolated by Robert Noble and Charles Thomas Beer from the Madagascar periwinkle plant. Vinblastine's utility as a chemotherapeutic agent was first discovered when it was crushed into a tea. Consumption of this tea led to a decreased number of white blood cells;t herefore, it was hypothesized that vinblastine might be effective against cancers of the white blood cells such as lymphoma. Vinblastine is a chemical analogue of vincristine. It binds to tubulin, thereby inhibiting the assembly of microtubules. (Arora et al., 2010)

It is M phase cell cycle-specific and is an integral component of a plethora of chemotherapy regimens, including ABVD (Adriamycin,Bleomycin, Vinblastine, Dacarbazine) for Hodgkin's lymphoma. Vinblastine is a component of the regimen of choice for the treatment of metastatic testicular cancer. In the treatment of testicular carcinomas, vinblastine in association with other antitumor agents often results in a cure rate of over90% in patients. In adult Hodgkin's lymphoma, the Catharanthus alkaloids have raised the 5 year survival chances to 98% (Meyers, 2007). Vinblastine has been shown to combat cancer by interfering with glutamic acid metabolism. Vinblastine is also used in the treatment of Kaposi's sarcoma, mycosis fungoides and carcinoma of the breast (Einhorn and Donohue.,1977; Jones and Vasey., 2003).

2.2 Side effects

Catharanthus roseus is poisonous if ingested or smoked. It has caused poisoning in grazing animals. Even under a doctor's supervision for cancer treatment, products from this plant produce undesirable side effects (Kintzios and Barberaki., 2004).

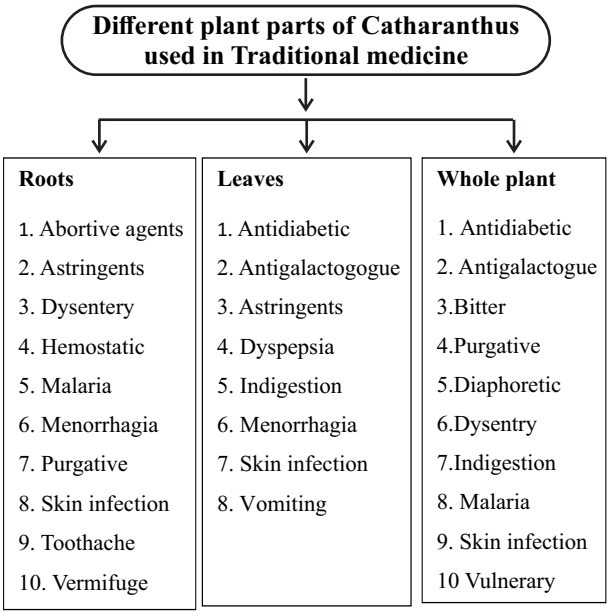

Fig. - 1 : Different plant parts of Catharanthus

used in Traditional system of medicine for curing diseases

3.0 Advantages of cultivating Periwinkle in barren lands

Cultivating of periwinkle of the following advantages:

1. Periwinkle is not eaten by domestic animals or damaged by birds.
2. Low incidence of pests and diseases.
3. Low labour requirement.
4. Less exhaustive and require less nutrients
5. Periwinkles easily grow on poor and marginal soil
6. Resistant to drought and pest
7. Periwinkle is easley cultivated with Minimum availability of irrigation water.

3.1 Cultivation practices for periwinkle

Fig. - 2 : Rose-purple flowers type variety

Fig. - 3 : White flowers type variety

Fig. - 4 : White flowers with rose purple spot in the centre type variety

3.2 Soil and climate

Grows well in tropical and sub-tropical areas up to an altitude of 900 m. Rain fed crop can be raised in areas with 70–100 cm well distributed rainfall. It can be grown on any type of soil except alkaline and waterlogged soils. Well drained, light soils are best suited.

3.3 Types of Varieties

There are three variants in periwinkle those with (i) rose-purple flowers (ii) white flowers, and (iii) white flowers with rose purple spot in the centre. The rose- purple is being cultivated because of its higher alkaloid content (Nejat., 2015; Senbagalakshmi., 2017). The Central Institute of Medicinal and Aromatic Plants, Lucknow has released two white flowered high yielding varieties, Nirmal and Dhawal (a mutant).

3.4 Season and sowing

Periwinkle crop can be raised either by direct seeding or by transplanting nursery grown seedlings. Direct seeding is generally adopted for growing a rain fed crop either through broadcasting (seed rate 5 kg/ha) or by drilling the seeds (seed rate 3 kg/ha) in rows 45 cm apart, at a depth not exceedi.tg two cm (due to shorter plumule length, deeper sowing results in poor crop stand) and thinning the seedlings a month after germination of the seeds, to maintain 15-30 cm plant to plant distance. Seeds are mixed with sand ten times up to their weight for even sowing, owing to the small size of the seeds.

For transplanting the crop, a nursery is raised during the summer months using 0.5-1.0 kg seeds/ha. Nursery beds are prepared by mixing equal quantities of sand and leaf mold with native soil. Seeds are sown in rows 10-15 cm apart at a depth of 1.5-2.0 cm and watered regularly. Seeds germinate in about 10 days and attain 15-20 cm height in 45-60 days, when they are ready for

transplanting in the main field at 30-45 x 15-30 cm2 spacing. Closer spacing produces thinner roots and wider spacing, thicker roots. Spacing needs to be adjusted based on the requirements of the industries for thinner or thicker roots. Treating the seedlings with Naphthalene Acetic Acid (NAA) (0.25 mg/liter) prior to transplanting is beneficial for trickery recovery from transplant shock. A nursery area of about 200 m2 is sufficient to raise seedlings for one hectare. This method of planting is recommended for areas with well distributed rainfall or with irrigation facilities.

3.5 Thinning and weeding

Periwinkle requires two weedings in the initial stage. First Weeding is done about 60 days after sowing/transplanting and the second weeding, 60 days later.

3.6 Irrigation

Places where rainfall is evenly distribute throughout the year, the plants do not require any irrigation. However, the areas where the monsoon is restricted to a particular period, 4-5 irrigation once in 15 days during February, March and April months are needed to get optimum yield.

3.7 Fertilizer application

The seeds of the green manure crop should preferably be treated with bacterial inoculants prior to sowing, to increase the development of root nodules which absorb atmospheric nitrogen and fix it in the soil. In case organic manure is not applied, it is advisable to apply a basal dose of 25 kg N, 50 kg P2O5 and 75 kg K2O per hectare per year.

3.8 Pests and diseases

Treat seeds with Captafol/Captan at 2 g/kg seed for controlling damping off of seedlings (*Pythium* and *Rhizoctonia* species). Spray Captafol/Mancozeb (0.3%) to control die back disease (*Pythium aphanidermatum*). Spray Rogor (0.06%) to control insect pests such as leaf hoppers.

3.9 Harvesting and drying

3.9.1 Roots: The crop is harvested after about 12 months from sowing. The crop is cut at about 7.5 cm above the ground and dried in shad. The field is then copiously irrigation and when it reaches at proper moisture level, it is ploughed and the roots are collected. The roots are washed thoroughly and dried in shade.

3.9.2 Leaves, stems and seeds: If there is demand for leaves, two leaf-strippings can be taken, the first one after 6 months and the second one after 9 months from sowing. Third stripping of leaves is also obtained when the whole plant is harvested. After harvesting, the whole plant is dried in shade. At this stage, light threshing will separate the seeds, which can be used for the next sowing. The leaves and stems are also then separately collected. Seeds collected this way will have fruits of various degrees of maturity and hence will have poor percentage of germination. It is, therefore, advisable that only mature pods should be collected during two or three months before the crop is harvested. This may be expensive, but there is no alternative. The aerial part of the plant between 7.5 cm and about 25 cm above ground level is taken as stem for the purpose of marketing.

3.9.3 Yield and Agro-economics

The production of root alkaloids of ajmalicine series varies from 0.1-0.2 per cent. Rainfed crop yields 1500-2000 kg of leaves and 600-700 kg roots and a net profit of more than Rs. 1,50,000per hectare. Likewise irrigated crop yields 3000-3500 kg leaves and 800-1000 kg roots and a net profit of more than Rs 2, 50,000-3,00,000 per hectare (Considering cost of the leaves Rs. 60/ kg and roots Rs.80/kg)

Conclusion and Future Prospects

Catharanthus alkaloids and their semi synthetic derivatives have been used in the clinic since a longtime and continue to benefit

innumerable cancer patients. The case of Catharanthus has been a successful one, where a lead from a plant has reached the bedside in modern medicine. Several other anticancer drugs of plant origin have yielded successstories, e.g. Taxol, combretastatins, camptothecin, etc. but the case of Catharanthus stands apart in view of its serendipitious discovery. There is a need to discover several such agents from nature's storehouse, given to us in the form of gift as plants. In view of export and in-house demand, several new factories are coming up in South India for manufacture of raubasine from *Cantharanthus* roots. Thus, there is increasing scope for cultivation of *Cantharanthus roseus* in India.

- Develop need-based package of practice in periwinkle crop
- Gave training and skill knowledge to the periwinkle farmer regarding value addition in periwinkle crop to increase income of the farmer
- Develop suitable variety of periwinkle with high yield and alkaloid content
- Government has to create organized market for sale of produce without interference of middlemen
- A holistic management action plan is necessary to formulate for assessment and management of resource base; best harvesting and processing practices and trade issues in periwinkle crop.
- The gaps between the grower and traders or buyers need to be minimized as these are at present very wide and often inequitable.

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AN INVESTIGATION IN PRE AND POST-HARVEST LOSSES OF VEGETABLES IN KANPUR DISTRICT OF UTTAR PRADESH

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Abstract

The study has examined the extent of pre and post-harvest losses of vegetable in Kanpur. Multistage sampling has been used for selection of 100 vegetable growers. The sample has also included 30 market functionaries. Five major vegetables have been selected for the study. The maximum aggregate losses have been found in tomato followed by brinjal, cauliflower, bottle gourd and okra. The pre-harvest losses at farmers level contributes for more than 40 percent of total losses at farmers level for all vegetables except cauliflower The study has suggested that establishment of producer co-operatives to handle various activities relating to production and marketing of vegetables would help in reducing losses.

Keywords : *Post-harvest losses, pre-harvest losses, Kanpur, U. P. , tomato, brinjal, cauliflower, bottle gourd, okra.*

INTRODUCTION

India occupies a pivot role in vegetable map of the world. The country is endowed large diverse climatic conditions, which enables production of more than 50 indigenous and exotic vegetables. Potato, tomato, onion, brinjal, cabbage, cauliflower, okra, peas and cucurbits are the major vegetables grown in India. Although the demand of vegetables is steadily rising, the production and marketing of vegetables face tremendous uncertainly on several counts. The vegetables production is constrained by its highly localized nature, seasonality and perishability. Moreover marketing of perishable commodities have some special problems in relation to transportation facilities, higher price spread and spoilage etc. All this lead to wastage of vegetables, while its movement from producers to consumer. It is observed that the losses of vegetables in our country due to inadequate post harvest handling, transportation and storage period are much high. According to Sharma and Singh (2011a), the over losses in vegetables can be up to 24 percent of total production.

The losses increased cumulatively as the produce moves down the pipe line from harvesting to its consumption by the consumer. Improper harvesting, handling, transportation and distribution results in significant losses. These losses include significant economic loss. If post harvest losses are minimized or eliminated, the growers will be naturally inclined to produce more. Many studies have attempted to estimate the postharvest losses at various stages of marketing of fruits and vegetables (Waheed et al., 1986, Atibudhi, 1987, Aradya et al.

1990, Madan and Ullasa, 1993, Gauraha, 1997, Srinivas et al., 1997, Sudha et al., 2005, Sreenivasa Murthy et al., 2003, Verma & Singh, 2004, Gangwar et al. 2007, Guhara & Thakur, 2008, Kumar et al., 2008 and Sharma & Singh 2011b). These studies have not separated the loss component explicitly after ripening. The losses in vegetables specifically after ripening occur mainly at farm level and during harvesting/marketing of vegetables. The farm level losses or pre harvest losses (after ripening) occurs before the process of harvesting begins, and may be due to insects, weeds and rusts. The losses during harvesting and marketing are generally termed as post- harvest losses. The pre-harvest losses specifically after ripening and before harvesting are inevitable whereas the losses occurring during the course of harvesting and marketing (post-harvest) may be eliminated with proper handling. Most of the studies conducted so far consider all the losses after ripening as post-harvest losses, which has aggravated the situation. Thus the present study is conducted for accessing both pre and post losses of vegetables in Kanpur district of Uttar Pradesh.

MATERIALS AND METHODS

The present study was conducted in Kanpur Nagar district of Uttar Pradesh. Since the region has vast potential for production, marketing and export of vegetables, it was purposively selected for the present study. For the selection of vegetables growers and market functionaries multistage sampling was used. At first stage, two blocks, namely Sarsaul and Bilhaur based on the maximum area under vegetables were selected. At the second stage, a list of all the villages of the blocks having at least 15 per cent of their cropped area under vegetables was prepared. From this list five villages of each selected block were chosen randomly. In all, 10 villages were selected for the study. At third stage 10 farmers per village were selected on the basis of probability proportion of area under vegetable cultivation. Thus the sample size was consisted of 100 vegetable growers from 10 villages of 2 selected blocks in district Kanpur Nagar.

The sample also includes market functionaries/traders dealing in the selected vegetables. One wholesale market Chakarpur and two retail subji mandies Ramadevi and Kalyanpur were selected, due to adequate arrivals of seasonal vegetables from the study area. Ten traders were selected from each market. As such total numbers of traders selected for the study were 30.

Several vegetable crops are cultivated in the region indifferent season. To identify the major vegetables, a list of vegetables along with their acreage was prepared for Kanpur Nagar district. Then two major vegetables namely brinjal and okra of *kharif* seasons, two major vegetables, tomato and cauliflower of *rabi* season and one vegetable, bottlegourd of *zaid* season were considered, respectively for the study on the basis of their higher share of area in respective seasons.

The study was based on the primary data collected from the selected farmers and market functionaries involved in the marketing using a pre-structured schedule by personal interview method. Data from the different agencies were collected during 2016 -17.

Analytical Technique

In the study losses in vegetables have been estimated at different stages. The losses were estimated to find out which vegetable incurred the maximum loss, as well as at which stage. Simple statistical tools like averages and percentages were used in the study.

RESULTS AND DISCUSSION

Losses in Vegetables

The losses in vegetables crops after ripening were incurred at farm level and during the process of

harvesting and marketing. The farm level losses in simpler terms they can be termed as pre-harvest losses after ripening occurs before the process of harvesting begins and may be due to pathogen/insect attack, weeds and rusts. The pre-harvest losses occurs after all the agro-management practices were performed, thus are uncontrolled by growers

The losses occurring during movement of produce from place of production to place of consumption or simply after harvest are termed as post-harvest losses. These losses occurs either due to inefficiency of growers or his ignorance in implantation of proper post-harvest technique like grading, packaging, storage and transportation etc. The present study is an endeavor in accessing both pre and post losses of vegetables. The pre-harvest losses have been estimated at field level, viz. diseased, hailed, damage by birds and animals and under size; whereas the post-harvest have been estimated both at farmer and trader level. The results of the analysis have been presented in Tables 1 to 5.

Pre-harvest Losses of Vegetables at field Level

The losses start immediately from the field level due to the attack of various insects, pests and diseases, which damage the produce and ultimately effect the yield and quality. The pre-harvest losses at field level have been tabulated in Tables 1. A perusal of Table reveals that the sample vegetables varied in nature i.e. from semi-perishables like bottlegourd, cauliflower to highly perishables like tomato, brinjal and Okra. Therefore, the extent of pre-harvest losses varied from vegetable to vegetable as well as at different stages. On overall basis, the maximum loss was estimated in brinjal (6.38%), followed by tomato (5.13%), cauliflower (2.44%), okra (2.39%), and bottlegourd (2.23%). On studying the losses at different stages, it was observed that in brinjal, tomato and cauliflower the maximum loss was due to under size. The okra registered maximum loss due to disease.

Disposal patterns

Since vegetable produce is highly perishable in nature, quick disposal of produce by the grower is prime objective. Total production, utilization and marketable and marketed surplus of selected vegetables are presented in table 2.

Table 1: Vegetable production and Pre- harvest losses at farm level (Quantity in Kg)

S.No.	Particulars	Brinjal	Okra	Tomato	Cauliflower	Bottlegourd
	Quantity Produced	17122	14835	29554	24514	23604
1	Diseases	226.42 (1.32)	148.28 (1.00)	342.73 (1.16)	152.27 (0.62)	127.3 (0.54)
2	Hailed	74.58 (0.44)	45.56 (0.31)	97.72 (0.33)	68.38 (0.28)	62.71 (0.27)
3	Damaged by birds & animals	158.62 (0.92)	117.33 (0.79)	163.81 (0.55)	142.35 (0.58)	138.76 (0.59)
4	Under size	633.2 (3.70)	43.58 (0.29)	912.34 (3.09)	234.71 (0.96)	198.71 (0.83)
5	Total	1092.82 (6.38)	354.75 (2.39)	1516.6 (5.13)	597.71 (2.44)	527.48 (2.23)
	Actual Production	16029.18 (93.62)	14480.25 (97.61)	28037.4 (94.87)	23916.29 (97.56)	23076.52 (97.77)

Note: Figures within parentheses show percentage to total production

It is evident from table that the production of brinjal on sample farms was 160.28 quintals. The farm utilization was 9.61 per cent of production. The quantity given to relatives accounted for 1.57 per cent, spoilage 2.45 per cent, kind payments 2.72 per cent and home consumption 2.42 per cent, respectively. The marketed surplus was 145.61 quintals (90.84 per cent) on sample farms.

In the case of okra, total production on an average was 144.80 quintals. The break-up of utilization reveals that spoilage (3.67 per cent), kind payments (2.94 per cent), produce given to relatives (2.29 per cent) and home consumption (2.16 per cent), respectively were the major items of utilization of okra production. Okra is highly perishable in nature, due to more than one season of production and lower unit value, the practice of putting them into cold storage is practically absent. Therefore the marketable and marketed surplus was equal.

Table - 2 : Utilization pattern of selected vegetable crops on sample farms(Quantity in kg)

S. No.	Particulars	Brinjal	Okra	Tomato	Cauliflower	Bottlegourd
	Production	16029.18 (100.00)	14480.25 (100.00)	28037.40 (100.00)	23916.29 (100.00)	23076.52 (100.00)
	Utilizations					
a.	Home consumption	388.02 (2.42)	314.14 (2.17)	1073.02 (3.83)	882.11 (3.69)	878.14 (3.81)
b.	Kind payments	436.01 (2.72)	426.08 (2.94)	824.19 (2.94)	663.02 (2.77)	723.11 (3.13)
c.	Spoilage	392.02 (2.45)	531.87 (3.67)	477.15 (1.70)	494.01 (2.07)	693.02 (3.00)
d.	Other relatives	252.01 (1.57)	331.09 (2.29)	471.01 (1.68)	617.04 (2.58)	664.04 (2.88)
	Total (a to d)	1468.06 (9.16)	1603.18 (11.07)	2845.36 (10.15)	2656.18 (11.11)	2958.31 (12.82)
3.	Marketable surplus	14561.12 (90.84)	12877.07 (88.93)	25192.04 (89.85)	21260.11 (88.89)	20118.21 (87.18)
4.	Marketed surplus	14561.12 (90.84)	12877.07 (88.93)	25192.04 (89.85)	21260.11 (88.89)	20118.21 (87.18)

Note : Figures in parentheses indicates percentage to total.

It was observed that average total production of tomato on sample farms was 280.37 quintals. Total farm utilizations was 10.31 per cent of production. The quantity given to home consumptions was 10.73 quintals, kind payments 8.24 quintals, spoilage 4.77 quintals and for relatives 4.71 quintals, respectively. The marketable surplus was 89.85 per cent.

It was also observed in cauliflower that total production was calculated on an average as 239.17 quintals on sample farm. The utilization worked out the home consumptions being 3.69 percent, kind payments 2.77 per cent, spoilage 2.07 per cent and for relatives 2.58 per cent, respectively. The marketable surplus was observed 88.89 per cent as well as marketed surplus was also found equal.

In case of bottle gourd, the total production observed on an average was 230.76 quintals. It varied in utilization and was calculated on an average as 3.80, 3.13, 3.01 and 2.88 per cent in home consumption, payment in kinds, spoilage and other relatives, respectively. The marketable surplus and marketed surplus were equal and it was found 87.18 per cent on bottle gourd vegetable farms.

Marketable surplus

Marketable surplus refer to that portion of the produce which is left for sale in the market, after meeting out family consumption requirements, and payment of labour in kind. Table 3 give an account of the marketable surplus of different vegetables available with the producer farms in percentage.

Table : 3 - Marketable surplus for different vegetables (in percentage)

S. No.	Crop	Percentage of Production
2.	Okra	88.93
3.	Tomato	89.85
4.	Cauliflower	88.89
5.	Bottlegourd	87.18

Table 3 shows that the percentage of marketable surplus on an average varied in different vegetables. It was highest being 90.84 per cent in brinjal followed by 89.85, 88.94, 88.89 and 87.18 per cent in tomato, okra, cauliflower and bottle gourd, respectively. However, marketable surplus amongst different vegetables did not show much variations. It was due to their perishable nature and also requirements of cash income by growers from the sale of vegetables.

Post-harvest Losses in vegetables

The post-harvest losses in vegetables occurs in production as well as in marketing. The were estimated at farmer level and trader level. The losses at farmers level were accessed during preparing produce for marketing (viz,. harvesting, assembling, grading and packaging); and transit or transporting the vegetables (physical and economic loss). In the absence of modern techniques like pre-cooling and refrigerated transportation, the vegetables are handled at high ambient temperatures, consequently the vegetables show considerable physical and physiological deterioration by the time they reach in the market. One thing, which is common in marketing of all vegetables, is the complete absence or lack of storage at producers level. During marketing operations some vegetables are damaged due to faulty method of operation and handling of produce.

The looses at traders level were accessed in two forms, viz. damage during handling and during sorting. Major share of vegetables produced in district Kanpur Nagar is being sent to distant markets for remunerative prices. Due to delicate nature of tomato, cauliflower, and long transit distance without safe packing can not with stand as compared to other vegetables. Therefore, wooden boxes with all round padding of prime needles are used for their packing. The brinjal, okra, cauliflower

and bottlegourd transported to the markets are packed in gunny bags. In case the vegetables are sent to local market, plastic crates are used for tomato and cauliflower. The extent of post harvest losses of selected vegetables at farmers levels and at traders' level are examined and presented in table 4.

Table : 4 - Losses in vegetables at different level (Quantity in Kg)

S.N.	Particulars	Brinjal	Okra	Tomato	Cauliflower	Bottlegourd
	Marketable surplus	14561.12 (100)	12877.07 (100)	25192.04 (100)	21260.11 (100)	20118.21 (100)
1	Losses during marketing preparation (kg)					
(i)	Picking/ harvesting	148.34 (1.02)	54.8 (0.43)	261.77 (1.04)	127.11 (0.60)	183.27 (0.91)
(ii)	Assembling	158.79 (1.09)	36.34 (0.28)	245.96 (0.98)	61.57 (0.29)	-
(iii)	Grading/ sorting	153.71 (1.06)	24.62 (0.19)	228.65 (0.91)	218.36 (1.02)	92.57 (0.46)
(iv)	Packing of produce	38.47 (0.26)	17.31 (0.13)	76.12 (0.30)	26.85 (0.13)	23.84 (0.12)
	Sub total	499.31 (3.43)	133.07 (1.03)	812.5 (3.23)	433.89 (2.04)	299.68 (1.49)
2	Losses during transportation					
(i)	Physical loss (pack marked/ pressed ambient temp.)	321.27 (2.21)	30.66 (0.24)	517.4 (2.05)	436.64 (2.06)	217.43 (1.08)
(ii)	Economic loss (Weight loss, Rotten, Broken/ Damaged)	118.14 (0.81)	18.92 (0.15)	227.39 (0.90)	266.37 (1.25)	80.14 (0.40)
	Sub total	439.41 (3.02)	49.58 (0.39)	744.79 (2.95)	703.01 (3.31)	297.57 (1.48)
	Total Loss at farmers level (Kg)	938.72 (6.45)	182.65 (1.42)	1557.29 (6.18)	1136.9 (5.35)	597.25 (2.97)
3	Loss at traders level					
(i)	Damage during handling	243.82 (1.67)	278.34 (2.16)	546.53 (2.17)	324.77 (1.53)	414.3 (2.06)
(ii)	Sorted out thrown out weight loss discarded	972.15 (6.68)	872.37 (6.77)	2128.35 (8.45)	1561.68 (7.34)	1643.79 (8.17)
	Total losses at trader's level (Kg)	1215.97 (8.35)	1150.71 (8.93)	2674.88 (10.62)	1886.45 (8.87)	2058.09 (10.23)
	TOTAL LOSSES	2154.69 (14.80)	1333.36 (10.35)	4232.17 (16.80)	3023.35 (14.22)	2655.34 (13.20)

Post- harvest losses at Farmer level: the section is devoted for discussion of PH losses at grower levelA perusal from table 4 reveals that sample vegetables varied in nature, from semi-perishables to highly perishables. Therefore the extent of losses varied from vegetable to vegetable as well at different stages. On overall basis, the maximum post-harvest losses at farmers level was estimated in brinjal (6.45 percent), followed by tomato (6.18 percent), cauliflower (5.35 percent), bottle gourd (2.97 percent) and okra (1.42 percent). On studying losses at different stages, it was observed that maximum loss was during preparing the produce for marketing except cauliflower where maximum loss was observed during transportation of the produce. During the transportation the maximum losses were registered as physical losses.

Losses at Traders level: In this section the post-harvest losses at traders level have been discussed. The wholesale transaction in vegetables were performed from early morning till around 11 am every day while retail transaction were performed throughout the day. The wholesalers in the study area were not found taking title in case of green vegetables due to their perish ability. The losses at traders level were worked out and have been presented in table 4. It was found that PH losses were registered maximum by tomato (10.62 percent), followed by bottle-gourd (10.23 percent), cauliflower (8.87 percent), okra (8.93 percent) and brinjal (8.35 percent). As far as losses at different stages are concerned, the maximum losses were estimated while sorting the produce during selling. The maximum loss during sorting was registered in tomato.

Total losses in Vegetables

The aggregate losses in sample vegetables were calculated by taking together the pre- harvest and post-harvest losses at producer level and traders level. Table 5 reveals that total losses were maximum in tomato (21.93 percent) and minimum in okra (12.74 percent). Hazarika (2006) and Sharma and Singh (2011a) have also observed maximum losses in tomato. The brinjal ranked second in the list registering 21.18 percent of losses, followed by cauliflower (16.66 percent) and bottle gourd (15.43 percent). Across different levels, it was found that losses were maximum at growers level in brinjal and tomato wheareas for bottle gourd, okra and cauliflower the losses were found maximum at traders level. The table further reveals that the pre-harvest losses at farmers level contributes for more than 40 percent of total losses at farmers level for all vegetables except cauliflower. Moreover in highly perishable vegetables like tomato, brinjal and okra pre harvest losses contributes for 45.36 %, 49.62 % and 62.73 % of total losses at farmers level respectively. The study explored that without inclusion of pre-harvest loss the PH losses may be over estimated, for instance total loss in tomato was 21.93 % but the post-harvest loss was only 16.80%.

Table : 5 - total losses in Vegetables (Percentage)

Particulars	Brinjal	Okra	Tomato	Cauliflower	Bottlegourd
Pre- harvest losses at farmer level	6.38	2.39	5.13	2.44	2.23
Post- harvest Loss at farmer level	6.45	1.42	6.18	5.35	2.97
Total losses at farmer level	12.83	3.81	11.31	7.79	5.20
Total losses at trader's level	8.35	8.93	10.62	8.87	10.23
TOTAL LOSSES	21.18	12.74	21.93	16.66	15.43

CONCLUSION

The study has estimated pre and post-harvest losses in major vegetables grown in Kanpur district of Uttar Pradesh. At producer level, the losses have been found maximum in brinjal (12.83%) followed by tomato (11.31%), cauliflower (7.79%), bottle gourd (5.20%) and okra (3.81%). The pre-harvest losses at farmers level contributes for more than 40 percent of total losses at farmers level for all vegetables except cauliflower. The highly perishable vegetables like tomato, brinjal and okra registered pre-harvest loss of 45.36 %, 49.62 % and 62.73 % of total losses at farmers level respectively. At the traders level, tomato has registered maximum loss followed by bottle-gourd, cauliflower, okra and brinjal. The maximum aggregate losses have been found in tomato, followed by brinjal, cauliflower, bottle gourd and okra. The inclusion of pre harvest losses, which so far has been ignored in the estimation has indicated that the existing methods have unduly over estimated the losses. Thus, it is appropriate to account for the pre-harvest losses separately for precise estimation of total loss.

Across different stages the losses in highly perishable vegetables (tomato, brinjal) have been found maximum at the grower level. The spoilage/loss of vegetables at the grower level results from lack of adequate knowledge about proper post-harvest management. Improper grading, packing, lack of storage and inadequate transportation facilities contribute more to the problem. One of the most important causes of losses is harvest at inappropriate maturity, resulting in erratic ripening and poor quality. Therefore, there is an urgent need of training the vegetable growers on scientific post-harvest techniques, if the vegetable production is to be sustained on a profitable basis in the region.

The study has suggested that one possible solution to tackle these problems could be the establishment of producer co-operatives to handle various activities relating to production and marketing of vegetables. This will not only help reduce the losses but will also increase the bargaining power of growers in marketing. It will help them in adopting consumer-oriented approach to vegetable marketing.

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ETHNOBOTNICAL POTENTIALS OF ACACIA SENEGAL GROWING IN BARMER (RAJASTHAN, INDIA)

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ABSTRACT

This paper summarizes the efforts to develop participation among villagers where uses of Acacia Senegal are not known its success depends on proper utilization of various plant parts.

Keywords *: Acacia senegal ethnobotnical potentials, utilization*

INTRODUCTION

Acacia senegal is widely distributed in the drier parts of Rajasthan, and is found throughout the area.It is deciduous shrub or small to medium-sized tree measuring up to 15 mt. in height; crown slightly rounded or flattened spreading with irregular virgate,glabrous to densely pubescent branches, with prickles just below the nodes, hooked downwards and the lateral ones curved upwards, reddish to blackish. Bark yellowish-brown to purplish-black, rough or smooth.Leaves alternate, bipinnate with minute stipules or absent,petiolate. Rachis sparingly to densely covered with hairs, rarely glabrous, pinnae in pairs, leaflets linear to elliptical-oblong, pubescent on both surfaces or glabrous.

Inflorescence an axillary spike up to 12 cm long, axis densely pubescent or glabrous. Flowers bisexual, white or creamy, calyx long, glabrous to somewhat pubescent, corolla 3–4 mm long; stamens numerous and long, ovary shortly stalked and superior, glabrous. Fruit an oblong pod, rounded to acuminate apically, yellowish- or greyish-brown to, dehiscent. Seeds subcircular-lenticular, 8–12 mm in diameter.

ETHNOBOTANICAL USES

Plants parts are variously used as under -

- **ROOTS:**
  Used for wound healing and burning sensation. Cordage is made either directly or after beating to extract the strengthen

fibers, suitable for well ropes and nets.

- **BARK:**

The bark is a powerful astringent is used in leucorrhoea, hemorrhages, wounds and ulcers, its decoction is used in diarrhoea and vaginal secretions, prolapse of the uterus and piles. The powdered bark of the plant with little salt is used for treating acute diarrhoea. Decoction is also used as a gargle and mouth wash in cancerous and syphilitic affections, sore-throat and toothache.Dry powder applied externally in ulcers. Stem bark is also used in diarrhoea, dysentery, diabetes, in skin diseases, in treating cough, bleeding piles,gonorrhoea, leprosy, leucoderma, bronchitis, seminal weakness, utero-vesicle disorders and as an anti-asthmatic anddiuretic.

The infusion of bark is given in chronic diarrhoea and diabetes mellitus. The juice of bark mixed with milk is dropped into the eye for conjunctivitis. The burnt bark and burnt almond shell both pulverized and mixed with salt to make a good tooth-powder. The ground bark mixed with seeds of Sesamum indicium Linn. has been used for food.

- **LEAVES:**

Infusion of tender leaves used as an astringent and remedy for diarrhea and dysentery. Also it is used in headaches, eczema, abscess, ophthalmic disorders, in throat infection, urinary problems and gonorrhea. Bruised tender leaves formed into a poultice and applied to ulcers act as stimulant and astringent. Tender leaves crushed into a pulp are administered in dysentery and diarrhea; decoction is used as an astringent enemata. Tender leaves crushed into a pulp are used as a gargle in spongy gums, sore throat and as wash in hemorrhagic ulcers and wound.

FLOWERS :

Flowers are used in reducing body temperature, in earache and are antidiarrhoeal, antidysenteric and used as tonic, It is used as source of honey.

- FRUITS:

Fruits used as an astringent and are injected to allay irritation in gonorrhoea and leucorrhoea. They are useful in diarrhora, dysentery and diabetes.

- PODS:

Pods are used as an astringent in diarrhoea, are also used as expectorant for impotency and in dry cough. Seed oil is antifungal. Seeds are eaten as raw or roasted in scarcity. Unripe or ripe seeds are used to make vegetables. Green pods are used as fodder. Pod decoction is used in urinogenital diseases.

- GUM:

Gum oozes from stems and branches which is a pale yellow to orangebrown. The sticky gummy substance dries on the branches to form hard solidwhich breaks with a glassy fracture. It is picked and sorted according to colour and size. The solution is colourless and free of taste and does not react readily with other chemical compounds. It is highly valued emulsifying, stabilizing, thickening and suspending properties. The gum is used to stabilize flavour oil for soft drinks and alcoholic drinks or as a stabilizer or clouding agent. It is used forspray flavours in dried food mixes and in the production of certain confectionery. Gum is used to prevent crystallization of sugar and as a glaze or

topping inbakery products, it is also used for encapsulating flavours in frozen dairy products.

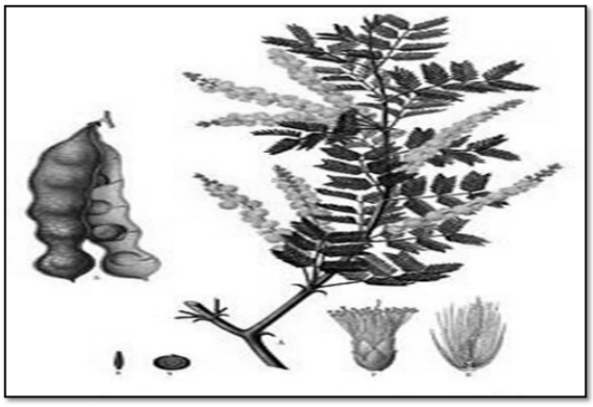
In pharmacology, it is used as a suspending or emulsifier or binding agentor as a coating prior to sugar coating in tablet manufacturing. In printing industryit acts as coating offset lithographic plates to prevents oxidation, to increase
theirhydrophilic properties and making them repellent to ink. It is base forphotosensitive chemicals. In ceramics it strengthen the clay. It is used inpyrotechnics, ink manufacturing, in textiles, paints, paper size and adhesives

It is locally used in special dishes and as chewing gum. Fried in ghee, it is used in preparing sweets, useful as a nutritive tonic and aphrodisiac in case of sexual debility.

It is useful as an astringent and tonic, play role in diarrhea, dysentery,diabetes, dry cough, in oral cavity lesions. It is also used as soothing agent for inflammations in respiratory, digestive and urinary tracts. Ii is used in burns, act as cooling, expectorant, as liver tonic, antipyretic and constipating, useful in asthma and seminal weakness. Powdered gum mixed with quinine is useful in complicatedfever cases. Ii is also used in skin diseases.

OTHER USES:

Acacia senegal is a multipurpose tree. The thorny branches are used fencing live stock or for protecting agricultural implements. It yields a fuel wood of good quality and charcoal. The foliage and pods are used as fodder fordomesticated animals. It is drought resistant tree planned for sand dune fixation, wind break and as shelter belts in arid regions'



CONCLUSION :

The relationship between the degree of vigour of trees and their ability to exude gum and the contingent role of pathogenic organisms in the induction of gummosis are still not well known. A negative correlation between soil water availability and relative air humidity on the one hand and gum yield on the other, has been observed in Acacia senegal, but this fact needs confirmation from other observations.

In arid north- western parts of India,Prosopis cineraria and Acacia senegal are prominent tree species which satisfy the food, fodder and fuel wood requirements of rural folk. Among them, the market and medicinal value of Arabic and seeds as vegetable make A. Senegal a commercial tree of the region. However, the natural gum production from A. Senegal is meager despite the occurrence of extensive stands of the species in the drier parts of Rajasthan.

Acacia based agroforestry system gives higher returns compared to sole cultivation of pearl millet or trees. Acacia Senegal provides seeds that can be used as vegetable and the gum extraction from the tree increase return from the system.

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Review Article

A STUDY ON HIGHER EDUCATION IN INDIA: ISSUES, CHALLENGE & DIRECTIONS

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INTRODUCTION

All india survey on higher education (AISHA) was initiated in 2011 during which data for the year 2010-11 was collected the survey was all most necessary as none of the source of data on Higher education was giving by complete picture of higher education in the country. For the first time all the major Stakeholders in higher education Such as university. Grants commissions all India council for Technical Educations, Medical council of India as well as State Governments participated in the data collection exercise. The entire survey was conducted through electronic mode dedicated portal http://asihe.gov.in was developed for the purpose. Thus making the exercise completed paperless. The survey intended to cover all the Institutions in the country engaged imparting the higher education. Data is being collected on several parameters such as teacher, students enrolment, programming examination results education finance, infrastructure etc.

1. Steering Committee and working Group:-

The XII plan categorically highlighted the need for a strong current and comprehensive data for evidence- based policy making and effective planning. The plan document into took note of the all India survey on higher education initiated by the ministry of Human Resource Development and indicated that it can provide useful insights and can be the first step towards creating a comprehensive higher education data managements system keeping this in view ,a new plan scheme higher Education statistics and public information system (HESPIS) has been approved in XII Five year plan with a view to ensure coordinated approach to all these efforts, particularly data collection efforts and benefit from synergy in such efforts, a steering committee for higher Education statistics and public information system has also been constituted under the chairmanship of secretary (Higher Education).

2. Identification of Institution for coverage:-

The Institution have been classified in following 3 broad categories.

(A) University and University Level Institution:- The Institution which are empowered to award degree under some act of parliament or state Legislature.

(B) Colleges/Institution:- which are not empowered to provide degree in its own name and therefore are affiliated / recognized with Universities.

(C) Stand : Alone Institutions (Not affiliated with universities) which are not empowered to provide degree and therefore run Diploma Level programmers. During the survey , 5 types of such Institutions have

been covered These are,

1. Technical Such as polytechnics.
2. Post Graduate Diploma in management recognized by AICTE.
3. Teacher training such as District Institute of Education and Training recognized by National Council for teacher Education.
4. Nursing Institutes recognized by Indian Nursing Council.
5. Institutes directly under the control of various Central Ministries.

3. Reference period for AISHE 2015-16 :-

Reference data for filling up the data capture formats was 30th September 2015. The number of institutions , teachers and students has been recorded on the basic of their actual number as on 30th September 2015 . Information is respect of Examination Result has been collected the students passed out/ awarded degree on or before 30th September, 2015 for the previous academic year.

4. Formulation of Concepts and Definition and Instruction Manual:-

All the terms generally used in higher education such as University colleges , programmers descriptive, faculty, department have been clearly defined in the instruction manual, which also includes item- wise instructions to fill the forms, Concepts and Definition used in the survey.

5. Partner Agencies:-

Statistics division of MHRD is primarily responsible for formulation and design of the survey which includes preparation of DCE, providing training to nodal officer's in workshops engagement with National Informatics Centre (NIC) in software development etc. The software support was provided by NIC Several regulatory authorities such as UGC, AICTE, MCI etc. Also took part by instructing their institutions for providing information in the Survey model officers in each state are expected to coordinate the Survey work. Most of the states have nominated Higher/Technical education department as Modal department/ Agency for coordinating the Survey.

6. Durations of the Survey AISHE 2015-2016:-

The Survey started in the month of December 2015 and continued till June 2016. One of its special features is that data such as basic detail name of facilities/Department & lived of programmers can be pre filled in future survey DSF from the previously filled in DSF with on option to edit pre filled data.

7. Institution uploaded Data under Survey:-

In AISHE 2015-16, 754 Unversities, 33903 colleges and 7154 stand Alone Institution have uploaded the form on the portal. However, in addition to the actual response received during AISHE 2015-16. Data has been pooled form the AISHE 2014-15 and 2013-14 for the institution which existed in 2015-16 but could not upload the data. So by pooling the results are actually based on response from a Larger number of institution than the actual response of 2015-16 survey which can be seen from the following table:-

S.N.		**University**	**Colleges**	**Standalone**
1	Listed for AISHE 2015-16	799	39071	11923
2	Response in AISHE201516	754 (94.4%)	33903 (86.8%)	7154 (60%)
3	Total Number of Institutions after pooling data from AISHE 2013-14 and AISHE 2014-2015	774(96.9%)	35667(91.3%)	7915(66.4%)

Source , All India Survey on Higher Education.

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Research Commentary

UTTARAKHAND, THE LIGHTHOUSE OF BIODIVERSITY CONSERVATION- LINKING CULTURAL ECOLOGY WITH SPIRITUALITY AND SUSTAINABILITY

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The Himalaya is known world-wide for rich biological diversity in the geologically young mountains and this attracted the people world-wide for appreciating this unique ecology for adventures tourism and biological exploration. Mythologically, the Himalaya has spiritual bearing in Hinduism, for the very reason that this region is believed to house the Gods who have relevance to production, protection and conservation, namely the Brahma, Vishnu and Mahesh. The `Char Dham' in the state of Uttarakhand in the Central Himalayan region is one of the popular examples that attracts over a crore of spiritual tourists every year.

Ecologically, the region in general and Uttarakhand in particularis known for biological endemism amidst higher frequency of natural calamities such as landslides, earthquakes, cloudburst and flash floods. Globally, the Himalaya is also known for the ecosystem services to the Asian region as well as to the world at large for maintaining slope stability, regulating hydrological integrity, sustaining high levels of biodiversity and human wellbeing. Reportedly, the Indian Himalayan Region is a dynamic landscape with a rich and remarkable biodiversity. The region comprises 10000 plant species (including 31.6 % endemics), 300 mammals (4.0%), 979 birds (1.5%), 176 reptiles (27.3%), 105 (40%) amphibians, and 269 fresh water fishes (12.3%). Further, the central Himalayas have more faunal diversity with 14,183 species than in the western and/or eastern zones (Kumari and Tewari, 2009). Rightfully, the region abodes 131 protected areas, which cover 9.6% of the entire protected area of the country, almost the same as the Western Ghats (10% of protected areas), another biodiversity hotspot in the country. The protected areas include 20 national parks, 71 wildlife sanctuaries, five tiger reserves, four biosphere reserves and seven Ramsar Wetland sites (Jain, 2010).

Culturally, the region harbours livelihoods of over 250 tribes and indigenous communities who have associated the lifestyle suiting to the resource availability in the region such as medicinal plants, wild edible and other non-timber forest products. For instance, the region supports over 20% medicinal plant species in India and has over 675 of wild edible species.

Nonetheless, the life and livelihood system in the Indian Himalayan region is vulnerable also to climate change, as the frequency of extreme climatic events is increased day by day. While the challenges are many, it also provides opportunities to develop adaptive strategies to help sustain life and livelihoods in the region. This is also one of the reasons for the rich cultural diversity and agri-food

systems in the region where one could see advanced pastoralism in the high hills to well integrated farming systems as in remote areas such as in Pithorogarh.The state records over 250 landraces of food crops that hitherto fortified the essence of traditional mechanism of human nourishment (Negi, 2010). Likewise, abundant medicinal plants added valueto the sustainable traditional healthcare.Realizing the potential of the State and the region *per se*, the first agricultural college was established in Pantnagar with a hill campus to explore and pursue agriculture-centric human development and enable conservation of the rich forest resources eventuallyin the state.While the forest-based biodiversity has drawn adequate attention of every one, the richness of agrobiodiversity warrants focus in the state, as this one of the visible outcomes of the century-old mutual interaction between land, technology, living beings, and traditionalsocial system. Such landscape level interaction of the traditional societies with the natural systems has generated a unique resource-based knowledge system (known as cultural landscapes) that is abundant amongst communities living in the state, awaiting scientific validation. Despite these sustainable bioresource based livelihoods, the state has witnessed large-scale outmigration due tolow productive agriculture*in situ*, lack of market access and lucrative alternative income generating sources elsewhere. But the recent reversal of low-income level migrants back to the state due to covid-19 pandemic will also provide ample opportunities for development the mountain agriculture *per se*. Across time and space, the state could however claim itsposition as the Water Tower in the Indian Himalayan region for hydro-electric power generation in the background of the historic, women-driven `tree hug' movement in this Central Himalayan state (Snegar, 2018) towards ecological conservation for ecosystem good and services.Over all, the Uttarakhand Mountains, due to their exclusive and inimitable biodiversity, geological sensitivity and geographic vulnerability, deserves utmost priority for ecological and environmental conservation in the national agenda. So, we call the state, a light house that speckled the philosophy for linking cultural ecology with spirituality and sustainability for biodiversity conservation in the region, as we celebrate the International Day of Biodiversity on the 22nd May this year, with the theme `*Our Solutions are in Nature*', and approach towards environmental restoration (UN, 2020) as declared by the United Nations.

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APPLICATION FOR THE MEMBERSHIP OF SBSRD ALLAHABAD

(Registered under Soc. Reg. Act –1860)

Regd. Office: 10/96, Gola Bazar, New Jhusi, Prayagraj, (U.P.), India

Membership type (Please tick): *Life ☐ Annual ☐

Photo

1. **Name (in capital)** .....
2. **Designation** .....
3. **Affiliation** .....
4. **Address** .....
   .....
5. **Date of Birth** .....
6. **Mobile/Phone Nos** .....
7. **Email ID** .....
8. **Website (if any)** .....
9. **Academic Field** .....
10. **Research Field** .....
11. **Experience** (in years) **a)** Research.....**b)** Teaching.....
12. **Honours/Awards** (Nos.) **a)** National.....**b)** International.....
13. **Fellowships** (Nos. only) **a)** National.....**b)** International.....
14. **Publications** (Nos. only)
    (i) Research Papers/Rev. Articles.....**(ii)** Books/Monographs.....
15. **Fee Details** .....

Declaration: I hereby declare that the Information furnished above is true to the best of my knowledge and belief and I am abiding by the rules of the Society of Biological Sciences and Rural Development, Allahabad.

Date:..... **Signature:** .....

MEMBERSHIP OF SBSRD, ALLAHABAD

Category	Indian
1. Annual	Rs. 500/-
2. Life	Rs. 4000/-
3. Institutional	Rs. 10,000/

The payment should be made through Demand Draft/E - Banking

favour of ***"Socity of Biological Sciences and Rural Development, (A/c No. 31105794798) Payable at State Bank of India, Jhusi Branch (IFSC Code SBIN 0005440), Prayagraj, U.P., India.***