5. Construction of battery of tube wells in the flood plain of river Ganga:

It has been observed that the flood plain of river Ganga is quite potential and has huge ground water resource, the construction of battery of tubewells in flood plain area would certainly mitigate the ground water crisis on the pattern of 24/7. It would also reduce the stress on ground water in central and other part of the city (away from bank of river Ganga).

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EFFECT OF FOLIAR APPLICATION OF NITROGEN AND PLANT GROWTH REGULATORS ON VIGOUR, YIELD AND GENERATIVE CHARACTERS OF STRABERRY (Fragraria Anansa Duch) cv. CHANDLER in ALLAHABAD CONDITION.

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ABSTRACT

The cultivar chandler of strawberry gave significant response to nitrogen and plant growth regulators viz. GA3 and NAA to vigour and generative characters of plant when applied as foliar spray. The highest value of plant height (19.95 cm), number of leaves (16.98) crown per plant (3.51) runner per plant (2.54) were recorded in T3 ie.100 ppm GA3 when applied twice as foliar spray at one month after planting and 15 days after first flowering.

The reproductive characters were also found to vary significantly. Minimum days (75 days) were taken to first flowering in 150 ppm NAA, while values were highest (16.19) for number of flowers per plant, number of fruit set per plant (15.10), duration of harvesting (9.91) and yield per plant (110.20 g) in 100 ppm GA3 when applied twice . Conclusively, 100 ppm GA3 proved best among the chemicals tried for vigour, generative characters and yield when applied twice i.e. 1st at one month after planting and 2nd at 15 days after 1st flowering.

Key Words: *S*trawberry, yield, vigour, urea, nitrogen, foliar spray, reproduction.

Strawberry is an important deciduous berry fruit which can be grown in diversified climate from temperate to tropical region with assured irrigation facilities. It behave annual in subtropical region and perennial in temperate. Being peculiar in climate requirement it needs inputs as in precision farming. Exogenous application of plant hormones has found beneficial to crop growth and yield (Singh and Chamber 20007). Hormones like NAA, GA3 reported to improve number of shoots and fruits per plant, berry size and yield per hectare. Higher yield with better exportable quality have in demand from past time. Usually, yield is inversely proportion to quality and both factors are difficult to come together.. Hi-Tech Horticulture has opened certain devices to mitigate such problems. Exogenous application of plant growth hormones and Urea are the novel example of such type of devices. Plant growth regulators have been tried to enhance quality yield and hence profit per unit of time and input investment. They are organic substances required in very minute quantity to modify the entire aspects related to plant life.

Auxins (NAA) are promoters in nature and exploited for various purposes as growth, flowering, fruit setting, fruit weight, yield quality and plant vigour with specific concentration and time. Straw berry plant has been found very sensitive to exogenous application of the hormones. It responds well with all aspects of life processes in one or other way (Pathak and Singh, 1976). Allahabad conditions yet have not been tested comprehensively for the acclimatized cultivars of strawberry. Remunerativeness have had remained a limiting factor in said area. As productiveness of crop is too inferior to compete in market.

Keeping above facts in view the experiment was under taken on the effect of foliar application of nitrogen and plant growth regulators on vigour, yield and generative characters of strawberry cv. Chandler in Allahabad condition.

MATERIALS AND METHODS

A field experiment was conducted at the Department of Horticulture, Kulbhaskar Ashram Post Graduate College, and Allahabad during the year 2010-11 and 2011-12.There were 10 treatment combinations laid out in Completely Randomized Block Design with replication. The treatments were :T1(60 ppm GA3), T2(80 ppm GA3), T3(100 ppm GA3), T4(50 ppm NAA), T5(100 ppm NAA) , T6(150 ppm NAA), T7(0.5 % Urea), T8(1.0% Urea) , T9 (1.5 % Urea) and (control). The recommended dose of NPK fertilizers as P_2O_5 (90 kg/ha.), K_2O (100Kg/ha) and N (80Kg/ha) in the form of SSP, MOP and Urea were applied. The Nitrogen was applied in tow split doses i.e. half in September (at the time of transplanting) and the remaining half before blooming. Hormones were dissolved in distilled water and applied instantly to avoid oxidation. Chemicals were applied twice i. e. first a month after planting and second 15 days after first flowering. All measurements were taken in triplicate using standard procedure. Measurements viz, plant height (cm), number of leaves/ plant, number of crown/ plant, number of runners/ plant, days taken to produce first flower, number of flower/ plant, number of fruit set /plant, duration of harvesting (days) and yield/ plant (g) were recorded.

RESULTS AND DISCUSSION

The plant height was highest (19.95cm) in 100 ppm GA3 closely followed by 18.80 cm in 80 ppm GA3 and 17.30cm in 60 ppm GA3 respectively. After GA3, urea and NAA were found better over control. Between this Urea was significantly better over NAA. All the treatments were significantly superior over control. GA3 is now well proved for its ultra cell elongation as it surprisingly break down genetic dwarfism .GA3 primarily elongates plant through cell elongation mechanism at sub-meristemetic regions of the plant. Strawberry is a vine of moderate apical dominance in nature which needs numerous shoots for profuse flower and fruit production.GA3 has done this

ANALYSIS OF GROUND WATER PROBLEMS

Rapid extraction of groundwater in the city has resulted into decline in prelatic groundwater level and reduction in discharge of tube wells during summer season. On the basis of current ground water withdrawal, rainfall and decline in water level (last five year) the projected demand and its consequence on ground water has been analyzed and tabulated below keeping the current rainfall pattern and population growth.

Table 4 : Decline trend of ground water level and projected demand.

Present Water supply (MLD)	Water Level Decline (2006-2010)	Projected Demand by 2015 (MLD)	Projected Water Level Decline by 2015	Name of city
251	25- 80cm/yr	285MLD	60cm/yr	Allahabad

It is also observed that ground water trough is created in Central part of the city due to excessive withdrawal of ground water and poor natural recharge.

MANAGEMENT OPTIONS

Since, the groundwater problems as envisaged on the basis of existing data has been analyzed, the following management options are suggested to improve the ground water condition.

1. Tapping of different aquifer zones in different pocket of the city

Since the city have two to three tier aquifer system, the tapping of different depth of aquifer would ease the stress on ground water particularly in the area where ground water trough is being created.

2. Roof Top Rain Water Harvesting

The natural recharge of groundwater has been drastically come down over the years in the city, there is need to adopt Roof Top Rain Water Harvesting at large scale in central and western part of the city. Since, sand layer is encountered in the city with top clay layer from 6.00 to 23.00m, the recharge wells are quite suitable for ground water recharge with quite precautionary measures.

3. Recycle and Reuse of Domestic waste water:

Due to rapid urbanization in the city, the numbers of hotels, restaurants and other complexes have been increasing over the years. The domestic waste water from these places can be made utilizable after natural filtration. It may be made mandatory to all the commercial complexes to have the recycle and reuse the domestic waste water. (S.C.Santra 2008)

4. Regulation on excessive groundwater withdrawal and misuse

It is fact that at least 20-25% of water supply become waste due to leakage and convenience losses apart from the unregulated withdrawal of ground water. Since shallow tube wells are running at large scale in the city, the stress on first aquifer is more and in future it would be much more. Therefore, there is need of regulated ground water withdrawal through shallow tube wells. (Gurjar and Jat 2008)

resulted into indiscriminate ground and surface water withdrawal over the years and led into many problems related to portable drinking water supply.

LOCATION, EXTENT AND DEMOGRAPHIC FEATURES OF ALLAHABAD CITY

The Allahabad city is limited by Latitude of 250 27" to 250 45" and Longitude of 810 24" to 810 50". It covers an area of 70 Sq Km with elevation of 96 to 98mamsl. The master slope is towards river Ganga. It is bounded by Phaphamau in North, Jhunsi in East, Bamrauli in West and Naini in South. (D.S. Pandey. 1998)

Table 1: Demographic features of Allahabad City

Name of City	Population 2001	Population 2011	Decadal Population Growth
Allahabad	4,936,105	5,954,391	20%

EXISTING WATER SUPPLY

The domestic water supply is based both on groundwater and surface water in Allahabad city. The analysis has been made for city regarding water supply with source during the period of 2005-2010. The analysis has been tabulated as under:

Table 2: Source -wise water supply in Allahabad City

G.W. supply	Surface Water supply	No. of Mini tube wells	No. of Deep tube wells	Year
152MLD (71%)	72MLD (32%)	33	161	2005
175MLD(72%)	69MLD(30%)	245	200	2010

GROUND WATER SCENARIO IN ALLAHABAD CITY:

As ground water is important source of water supply in the city ,the ground water behavior has been changing over the years. It is also fact that the city have privilege of having almighty river Ganga which has been very important source of replenishment of ground water and its flood plain as ground water repository. But over the years, the gap in water supply and demand, reduction in discharge of river Ganga and its contamination has necessitated to think about the extraction of groundwater at larger scale in the city. Indiscriminant extraction of groundwater through tube wells has resulted into the decline of ground water level at significant magnitude. The depth to water varies from 4.00 to 23.00mbgl during permission (As per record of Piezometer) in Allahabad city with an average of 2.00to 3.80m seasonal fluctuation. The decline in water level has been recorded from 15 to 80cm/year in different pocket of the city. Groundwater trough has been created in Civil line area due to huge extraction of groundwater and insignificant of natural recharge. The average groundwater level vis-à-vis rainfall have been analyzed during last five years (2006-10) and tabulated below:

Table: 3 Water level behavior and Rainfall in Allahabad city.

Average Water level (Pre monsoon) 40Pz	Averae Water level (Postmonsoon)	Rainfall (mm)	Year
11.39	12.57	995.81	2006
15.87	12.00	1108.61	2007
13.51	10.90	1238.10	2008
16.21	13.25	619.8	2009
17.00	14.31	787.00	2010

function efficiently and resultantly plant height was exceptionally greater with GA3 treatment. Intercalary and nodal tissues remain in juvenile form for longer period which allows the plant to sprout more shoots and hence flowers and fruits. Nutrient absorption and assimilation ability of plant based on development of vascular tissues. Sieve tubes and xylem vessels become more developed with GA3 treatment. Metabolites channelization become proper and hidden hunger like condition does not exist. Pediceller attachment of flower becomes strong hence the problem of flower is minimized significantaly. Strawberry is a flashy fruit which is a callus of juicy cells. These juicy cells become more vigorous with GA3 treatment. The water retention ability of the cell also increased manifold which ultimately augmented the weight of the fruit, hence the yield. Urea is nitrogen containing fertilizer therefore increased plant growth was observed with foliar application of urea.higher concentrations have given better results. Plant vigour viz. plant height, number of leaves/plant, number of crowns / plant and number of runners /plant was significantly greater over NAA treatment. Reproductive parameters viz. days taken to produce first flower, number of flower /plant, number of fruit set /plant, duration of harvesting (days), and yield /plant (g) were also better than NAA and control. NAA is an auxin which mainly responsible for cell division of plant therefore plant vigour could not maximized as done by GA3 and urea application. Though the values for plant vigour and reproductive parameter were better over control.

TABLE-1. EFFECT OF FOLIAR APPLICATION OF NITROGEN AND PLANT GROWTH REGULATORS ON VIGOUR OF STRABERRY (Fragraria anansa DUCH) CV. CHANDLER IN ALLAHABAD CONDITION.

Sl. No.	TREATMENTS	PLANT HEIGHT (CM)	NUMBER OF LEAVES/ PLANT	NUMBER OF CROWNS / PLANT	NUMBER OF RUNNERS / PLANT
1	T1 GA_3 60 ppm	17.30	14.94	2.93	2.01
2	T2 GA_3 80 ppm	18.80	15.35	3.00	2.23
3	T3 GA_3 100 ppm	19.95	16.98	3.51	2.54
4	T4 NAA 50 ppm	15.94	12.85	2.05	1.63
5	T5NAA 100 ppm	15.80	13.00	2.26	1.67
6	T6 NAA 150 ppm	15.84	13.25	2.26	1.71
7	T7 UREA 0.10 %	16.07	13.95	2.10	1.75
8	T8 UREA 0.50 %	16.99	14.20	2.35	1.93
9	T9 UREA 1.50 %	17.28	14.90	2.90	1.98
10	T10 WATER SPRAY	14.33	11.45	1.98	1.54
11	SEd=+	0.45	0.48	0.09	0.07
12	CD at 5%	0.96	1.02	0.20	0.15

TABLE-2. EFFECT OF FOLIAR APPLICATION OF NITROGEN AND PLANT GROWTH REGULATORS ON

Sl. No.	TREATMENTS	PLANT HEIGHT (CM)	NUMBER OF LEAVES/ PLANT	NUMBER OF CROWNS / PLANT	NUMBER OF RUNNERS / PLANT
1	T1 GA_3 60 ppm	14.97	13.84	65.00	97.00
2	T2 GA_3 80 ppm	15.10	14.12	66.82	101.35
3	T3 GA_3 100 ppm	16.19	15.10	69.91	110.20
4	T4 NAA 50 ppm	13.96	12.70	60.01	90.20
5	T5NAA 100 ppm	14.00	12.94	61.29	92.60
6	T6 NAA 150 ppm	14.20	13.00	61.07	92.80
7	T7 UREA 0.10 %	14.28	12.25	63.62	91.30
8	T8 UREA 0.50 %	14.38	12.95	63.97	95.80
9	T9 UREA 1.50 %	14.95	13.81	64.48	96.99
10	T10 WATER SPRAY	12.61	10.95	58.00	70.05
11	SEd=+	0.46	0.43	1.05	2.02
12	CD at 5%	0.94	0.91	2.20	4.24

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GROUND WATER STRESS IN ALLAHABAD CITY AND ITS MANAGEMENT OPTIONS : AN ANALYSIS

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ABSTRACT

Unexpected increment in urbanization necessitated the withdrawal of groundwater over the years in Allahabad city, However city is situated in central Gangatic plain. In Allahabad city, the decline in water level has been recorded in the magnitude of 15cm to 80cm/year during last five years(2005-2010). (Ground Water Year Book of Uttar Pradesh(2008), of CGWB.) The reason for this decline is due to shift of water supply more through groundwater during last five years as well as 28% negative departure in the Rainfall pattern. From the year 2005, the no. of tube wells in the city has increased from 159 to 191 apart from the mini tube wells from 30 to 230 in number. The water supply from surface water is constant during 2005-2010 i.e.70 MLD. It clearly reflects the shift of water source towards groundwater extraction. The depth to water has been uneven in the entire city which ranges from 4.00 to 23.00mbgl (as per record of Piezometer). It is also observed that the decline in water level varies in different parts of the city but groundwater trough is being created in Civil Line area and rate of water level decline narrows down from central Allahabad towards adjacent to river Ganga.

The management plan to tackle the ground water problem include :-

i) tapping of different aquifer zones in different pocket of the city,
ii) Roof Top Rain Water Harvesting.
iii) Recycle and Reuse of Domestic waste water.
iv) Regulation on excessive groundwater withdrawal and misuse.
V) Construction of battery of tube wells in the flood plain of river Ganga to supply the drinking water in Allahabad city.

The city is well known for the oldest cultural heritage and religious antiquity. City is famous as “Prayag” which was renamed by Emperor Akbar in the year 1583. Allahabad is also very important holy city in the world which is bounded by two major rivers Ganga and Yamuna. Domestic water supply in the city depends from groundwater as well as surface water since ancient time. But the drastic change in mode of withdrawal or supply was taken place in 20th century due to mechanization of ground water withdrawal. This situation

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EFFECT OF SINGLE SUPER PHOSPHATE ON THE UPTAKE OF CADMIUM BY TURNIP

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ABSTRACT

A field experiment was conducted to find out the effect of single super phosphate (SSP) on the uptake of cadmium by Turnip (Brassica rapaL.) on the alluvial soil of Sheila Dhar Institute experimental farm, Allahabad. Three levels of single super phosphate (0, 100 and 200 kgha^{-1}) and Cd (0, 5 and 10 ppm) were applied as SSP and $CdCl_2$, respectively. Addition of 200 kgha^{-1} SSP increased the maximum shoot dry biomass and root yield of Turnip by 28.46% and 16.96% over the control respectively. The application of 10 ppm Cd maximum reduces dry biomass yield of Turnip by 16.38% compared to control and registered the highest accumulation of Cd in shoot and root of Turnip by 1.42 ppm and 3.26 ppm, respectively. Therefore, 200 kg ha^{-1} SSP applications may be recommended to enhance biomass yield of Brassica rapa L. The response of single super phosphate was observed ameliorative in Cd-contaminated plots.

Key words: Cadmium, single super phosphate, turnip, uptake.

Pollution of the biosphere by toxic metals has accelerated severely since the beginning of the industrial revolution. The primary sources of metal pollution include the burning of fossils fuels, mining and smelting of metaliferous ores, municipal wastes, fertilizers, pesticides, and waste water irrigation. Contamination of groundwater and soil by heavy metals leads to major environmental and human health problems. Plant metabolism is also affected negatively by the heavy metals (Singh and Agrawal, 2010).

Cadmium (Cd) levels in arable land have increased during the last century due to anthropogenic activities. Most of the Cd transferred to humans comes from food, especially plant food. Carrots are of particular concern due to a large consumption of this vegetable. In the body, Cd is stored and may disturb essential functions and cause diseases and organ failure (Holmkvist, 2009).

According to estimations 3 to 5% of the Cd in the food is absorbed during digestion (EFSA, 2009). In the body the absorbed Cd is bound to a protein (metallothionein) in the liver. Some of these complexes leach to the kidney

where Cd is accumulated in the kidney cortex (Arbetsoch, 2009). The highest concentration in the liver is reached at an age of 20 to 25 and in the kidney between 50 and 60 (EFSA, 2009). After that, the concentration slightly decreases.

Phosphate (P) fertilizers induced immobilization of heavy metals Pb, Cd, and Zn. Single super phosphate (SSP) was more effective in reducing Pb bioavailability than Cd but had variable effects on Zn bioavailability. The level of P fertilizers at application rate of 300 g/m2 was enough to reduce metals availability in the soil (with a reduction of up to 79% in WE Pb) and phytoability (up to 47% in V-Pb) at the first stage of remediation. Cd uptake by cabbage was a complex process and it should be careful to evaluate the impact of phosphate application on cadmium availability in soil. SSP application must be carefully designed to reduce Zn mobilization and co-application of liming materials with SSP may be necessary to offset potential soil acidification (Biling et al., 2008). The objectives of this study were to examine the effect of single super phosphate on the uptake of Cd and the effects on their respective concentration in roots yield and shoots dry biomass of Brassica rapa L.

MATERIALS AND METHODS

Plant Material and Experimental Layout

The Sheila Dhar Institute experimental site, covers an area of 1 hectare, is located at Allahabad in northern India at 25º57' N latitude, 81º50'E longitude and at 120±1.4 m altitude. A sandy clay loam soil, derived from Indo-Gangetic alluvial soils, situated on the confluence of rivers Ganga and Yamuna alluvial deposit, was sampled for the study. The texture was sand (>0.2 mm) 55.54%, silt (0.002-0.2 mm) 20.32% and clay (<0.002 mm) 24.25%. The detailed physico-chemical properties of the investigated soil have been given in the Table 1 -

Table-1. Physico-chemical properties of the Sheila Dhar Institute (SDI) Experimental Farm, Allahabad, India

Parameters	Values.
Texture: Sandy Clay Loam (Sand, Silt and Clay %)	(55.54,20.32 and 24.25, respectively)
pH	7.8
EC(dSm^{-1}) at 25^0C	0.28
Organic Carbon (%)	0.56
CEC [C mol (p^+) kg^{-1}]	19.8
Total Nitrogen (%)	0.08
Total Phosphate (%)	0.07
DTPA-extractable Cd (ppm)	0.26

Dissolved Oxygen ranged from 6.0 to 10.4 ppm. BOD ranged from 3.2 to 5 ppm. The highest values of BOD was recorded during mansoon months due to degradation activities of organic substances. pH range from 7.8 to 8.2. Conductivity values were recorded higher during winter months. Which may be due to dissolved substances. pH values influence, the life of aquatic organisms in various ways. Dissolved oxygen is very important parameter, during hypoxic conditions several organisms disappear. If we compare from earlier records defenetely increment in BOD and conductivity may create hazardous conditions for aquatic organisms in the Ganga river system.

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Shivkuti is an important sampling station which is nearer to Phaphamau bridge, this is located near Narayan Ashram Temple and is approximately 5 Km. far from University of Allahabad.

Various workers have studied hydrobiological parameters of the Ganga river system. Due to mass bathing the hydrological parameter showed alterations particularly during Kumbh Mela in the Ganga river at Allahabad (Singh et. al., 1996). The most affected parameters were TDS, Conductivity, DO and BOD. Chopra and Hashim (1990) observed that due to mass bathing and anthropogenic influences DO significantly decreased, TDS and conductivity showed significant increment during Nov. 1989 to Jan 1990 in the river Ganga at Haridwar. Thus various hydrological parameters were affected due to anthropogenic activities.

MATERIALS AND METHODS

Hydrobiological parameter were analysed by using portable water quality analyser. The standard techniques (APHA 1985, Golterman et. al. 1978) were followed for analyses of various parameters during Jan 2002 to Dec. 2002 at Shivkuti. Hydrobiological Kits were tested by using some chemical methods of water analysis.

RESULTS AND DISCUSSION

Using techniques various hydrobiological parameters were recorded at Shivkuti (River Ganga).

From the observations it is clear that

Table 1: Summary of hydrobiological observations on the Ganges river at Shivkuti, Allahabad

	Air ^{0}C	Water ^{0}C	pH	Conductivity µS	DO ppm	BOD
Jan.	**13.6**	**15.2**	**8.0**	**465**	**10.4**	**4.0**
Feb.	**14.9**	**17.3**	**8.1**	**467**	**9.6**	**3.9**
Mar.	**19.9**	**21.8**	**8.1**	**485**	**7.5**	**3.2**
April	**22.0**	**22.5**	**8.0**	**492**	**8.2**	**3.5**
May	**30.0**	**29.5**	**8.2**	**482**	**7.2**	**4.2**
June	**42.1**	**33.3**	**7.9**	**490**	**7.0**	**4.3**
July	**37.2**	**32.2**	**7.9**	**486**	**6.9**	**4.5**
Aug.	**27.5**	**29.4**	**7.8**	**303**	**6.0**	**5.0**
Sept.	**27.8**	**28.9**	**7.9**	**350**	**6.2**	**4.8**
Oct.	**25.4**	**26.2**	**8.0**	**372**	**6.8**	**4.1**
Nov.	**21.3**	**22.0**	**8.1**	**425**	**7.6**	**3.9**
Dec.	**15.1**	**18.2**	**8.2**	**415**	**7.8**	**3.4**

EXPERIMENTAL

After systematic survey factorial experiment was conducted to study the effect of single super phosphate on the uptake of cadmium by Turnip *(Brassica rapa L)*. The experiment was replicated thrice with nine treatments and conducted in completely factorial randomized block design (factorial RBD). After 24 hr of the treatment seeds were sown. Soil moisture was maintained by irrigating the crops at interval of 5-6 days.Turnip was grown successively in the 27 plots (each of 1m^2 in area). The treatments of Cd × SSP relationship consisted of 0, 100 and 200 kg ha^{-1} single super phosphate along with 0, 5 and 10 ppm Cd. The source of Cd and phosphate were $CdCl_2$ and SSP respectively. The crop was harvested at 60 days after sowing (DAS).The treatment combinations were as follows:-

(1). A_0B_0 (Control), (2). A_1B_0 [Low dose of cadmium (5ppm Cd)], (3). A_2B_0 [High dose of Cadmium (10ppm Cd)], (4). A_0B_1 [Low dose of SSP (100 kg/ ha)], (5). A_0B_2 [High dose of SSP (200 kg/ha)], (6). A_1B_1 [Low dose of Cadmium and SSP (5 ppm Cd along with 100 kg/ha SSP)], (7). A_1B_2 [Low dose of Cadmium (5 ppm) and High dose of SSP (200 kg/ha)], (8). A_2B_1 [High dose of Cadmium (10 ppm) and Low dose of SSP (100 kg/ha)], (9). A_2B_2 [High dose of Cadmium and SSP (10 ppm Cd along with 200 kg/ha SSP)].

SOIL SAMPLING

The larger fields were divided into suitable and uniform parts, and each of these uniform parts was considered a separate sampling unit. In each sampling unit, soil samples were drawn from several spots in a zigzag pattern, leaving about 2 m area along the field margins. Silt and clay were separated by Pipette method and fine sand by decantation (Chopra and Kanwar, 1999).

EXTRACTION FOR CADMIUM (Cd) CONTENT IN SOIL

For total Cd content, one gram of soil was mixed in 5 ml of HNO_3 (16M, 71%) and 5 ml of $HClO_4$ (11 M, 71%). The composite was heated up to dryness. The volume was made up to 50 ml with hot distilled water. The samples were filtered using Whatman filter paper 42 (42.5mm). The clean filtrate was used for the estimation of cadmium using Atomic Absorption Spectrophotometer (AAS) (Aanalyst 600, Perkin Elmer Inc., MA, USA) (Kumar and Mani, 2010).

SOIL PHYSICO-CHEMICAL ANALYSIS

Soil pH was measured with 1:2.5 soil water ratio using Elico digital pH meter (Model LI 127, Elico Ltd., Hyderabad, India) at authors' laboratory. Double distilled water was used for the preparation of all solutions. Organic carbon was determined by chromic acid digestion method, cation exchange capacity (CEC) by neutral 1 N ammonium acetate solution, total nitrogen by digestion mixture (containing sulphuric acid, selenium dioxide and salicylic acid) using micro-Kjeldahl method, Glass

Agencies, Ambala, India. Total phosphorus by hot plate digestion with HNO_3 (16M, 71%) and extraction by standard ammonium molybdate solution (Chopra and Kanwar 1999; Kumar and Mani 2010).

PLANT ANALYSIS

Plants were harvested after 60 days having higher phytochemicals at their maturity stage as suggested by Mani et al. (2012). Samples were carefully rinsed with tap water followed by 0.2 % detergent solution, 0.1N HCl, de-ionized water, and double distilled water.

Samples were dried in a hot-air oven at a temperature of 60 ºC and ground to a fine powder. Plant dry biomass weight was recorded. One gram of ground plant material was digested with 15 ml of tri-acid mixture (Kumar and Mani, 2010) containing conc. HNO_3 (16M, 71%), H_2SO_4 (18M, 96%) and $HClO_4$ (11M, 71%) in 5:1:2), heated on hot plate at low heat (60ºC) for 30 minutes and cadmium were determined by the Atomic Absorption Spectrophotometer (Aanalyst 600, Perkin Elmer Inc., MA, USA).

STATISTICAL ANALYSIS

Data were analyzed by factorial analysis of variation (ANOVA) using various treatments as independent factors with the help of the sum of square (SS) and degree of freedom (DF). The standard error (SE) is given by $SE = \sqrt{\frac{2V_E}{\blacksquare}}$ where, VE is the variance due to the error, n is the number of replications, and the critical difference (CD) is given by $CD = SE_{diff.} \times t_{5\%}$ ($t_{5\%}$= 2.042 at DF_{error}= 30 was observed) and standard deviation (SD) were determined in accordance with (Motulsky and Christopoulos, 2003).

RESULTS AND DISCUSSION

Effect of Cd × SSP interaction on root yield and shoot dry biomass of Brassica rapa L

The data presented in table 2 and fig. 1 revealed that Cd and SSP were observed significant on influencing the dry biomass and root yield of Brassica rapa L. Application of SSP @ 200 kg ha^{-1} at different levels of Cd (0, 5 and 10 ppm) treated plots produced root yield of 21.24, 20.76 and 20.45q/ha, resulted in 16.96%, 14.32% and 12.61% increase over the control plots, respectively. Similarly application of SSP @ 200 kg ha^{-1} at the aforesaid levels of Cd treated plots produced shoot dry biomass of 16.25, 16.12 and 15.67 q/ha, resulted in 28.46%, 27.43% and 23.87% increase over the control plots, respectively (Kumar et al., 2012; Mani et. al., 2014).

The combined application of 10 ppm Cd along with 100 kg ha^{-1} SSP also enhanced the root yield and shoot dry biomass production which were observed 20.12 and 13.78 q/ha,

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STUDIES ON HYDROLOGICAL CONDITIONS OF GANGA RIVER AT SHIVKUTI, ALLAHABAD

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ABSTRACT

Various hydrological parameters were recorded at Shivkuti. pH values ranged from 7.8 to 8.2, DO ranged between 6.0 to 10.4 ppm. Higher values of conductivity and BOD were recorded which may be considered as an indication of hazardous conditions.

Key Words: Hydrobiological parameters, Ganga river system, water analyses.

The world faces a wide range of ecological crisis related to inappropriate management of fresh water. Massive urban population growth in most regions has been enabled by moving huge amount of water from distant sources to cities. For humans the amount of potable water is required 5L per individual per day approximately and 45 L per day for other purposes like sanitation, bathing, food preparation etc. But due to anthropogenic influences clean water has become a difficult task today. The case of water related diseases like diarrhoea, schistomiasis, intestinal helminthes, malaria, cholera, biotoxins etc. have become very common today. The renewable freshwater resources have become non-renewable by mismanagement of water resources.

The Ganga river basin drains an area of approximately 814400 Km², spans three countries, India, Nepal and Bangladesh and is occupied by around 300 million peoples.

Ganga river system is the one of the most studied river system of the world. In the Indian mythology it is considered the most holi river. This is perrenial river and supports a lot of plant and animal species. Recently due to anthropogenic influences, change in land use pattern, habitat destruction, invasive alien species, vast increment in human population, urbanization, organic and chemical pollution etc. the water quality of Ganga river system has been considerably changed which is harmful for human being and other aquatic organisms. In Allahabad region Ganga river system is the main source of water and capture fisheries.

The main fish landing and water sampling spots are Mehdauri, Rasolabad, Shivkuti, Daraganj, Sangam (Fishing is prohibited), Gaughat and Sadiapur.

resulted in 10.79% and 8.93% increase over the control, respectively, indicating ameliorative role of SSP addition in plots. The application of Cd at 10 ppm registered the minimum root yield and shoot dry biomassup to 17.56 and 10.87q/ha showing maximum retardation in growth to the extent of 3.42% and 16.38% respectively over the control due to the presence of excess Cd in the root environment (Biling et al., 2008; Mani et al., 2014).

Table 2: Effect of Cd × SSP interaction on root yield and shoot dry biomass (q/ha) and Cd concentration (ppm) of *Brassica rapa L*

Cd-rate (ppm)	SSP kg ha^{-1}	Root Yield	Shoot Dry biomass	Cd concentration (ppm)	
				Root	Shoot
0	0	18.16	12.65	0.26	0.10
	100	20.56	15.72	0.21	0.12
	200	21.24	16.25	0.14	0.08
5	0	17.96	12.12	1.65	0.25
	100	20.25	15.48	0.96	0.32
	200	20.76	16.12	0.28	0.21
10	0	17.56	10.87	3.26	1.42
	100	20.12	13.78	1.54	0.93
	200	20.45	15.67	0.31	0.27
	SE=	0.74	0.65	0.20	0.019
	CD=	1.57	1.38	0.42	0.039

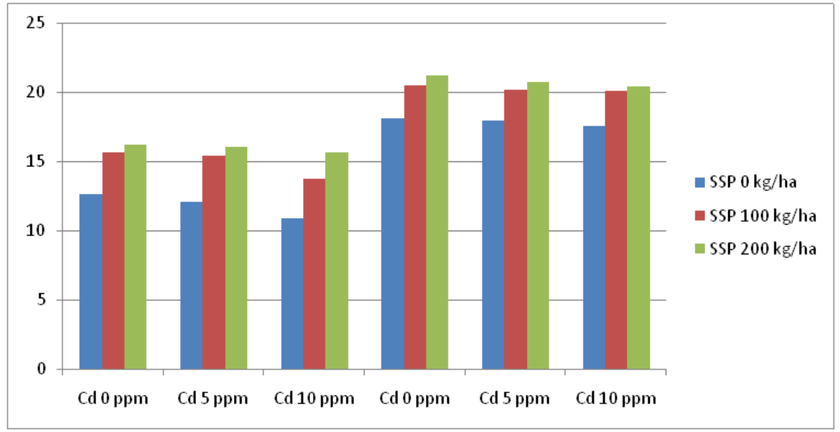

Fig. 1: Effect of Cd × SSP interaction on shoot dry biomass and root yield of *Brassica rapa L*(q/ha)

Effect of Cd × SSP interaction on Cd concentration in shoot and root of *Brassica rapa L.*

The data (Table 2) indicated that the effect of Cd, SSP and Cd × SSP interaction were observed significant. Accumulation of Cd in roots and shoot of plants significantly increased and indicated greater relative Cd accumulation from control to Cd added plots. Application of 10 ppm Cd of maximum increased the accumulation of Cd shoot and root of *Brassica rapa L* by 1.42 and 3.26 ppm, respectively (Fig. 2 and 3). Application of Cd 10 ppm+ SSP 200 kg ha^{-1} (T_9) decreased the accumulation of Cd 0.27 ppm and 0.31 ppm in shoots and root of Brassica rapa L compared to non-amended plot, respectively. Added single doses of SSP 200 kg ha^{-1} reduced minimum the shoot and root Cd uptake of *Brassica rapa L* by 0.08 and 0.14compared to control plots, respectively (Chen and Zhu, 2004; Biling et al., 2008; Mani et al., 2014).

The addition of P may reduce Cd phytoavailability through a combination of several mechanisms, such as sorption (including phosphate-induced Cd adsorption and surface complexation), precipitation, or coprecipitation (Laperche and Traina, 1998; Valsami-Jones et al., 1998; Biling et al., 2008). However, there were no Cd phosphate minerals formed freshly by the end of experiment identified with XRD (Ma et al., 1994), and it was speculated that a solid residue containing Cd was Ca-Cd phosphate or CaPb-Cd phosphate (Ma et al., 1994; Valsami-Jones et al., 1998). Chen et al. (1997) suggested that reduction in aqueous Cd concentrations with apatite addition occurred primarily because of sorption mechanisms, such as surface complexation and ion exchange rather than precipitation of Cd phosphate.

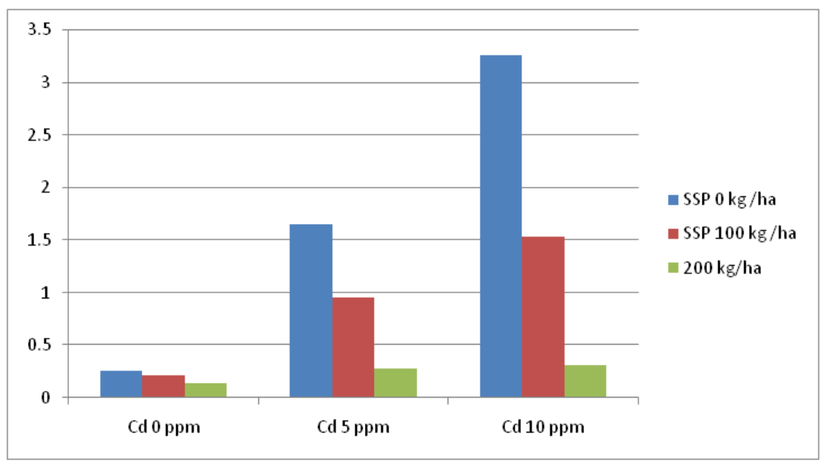

Fig. 2 : Effect of Cd × SSP interaction on Cd concentration in root of *Brassica rapa L* (ppm)

Subject Matter Specialists and Sub Divisional Extension Officers. There were 19.23 per cent and 14.81 per cent contact farmers of Kalyanpur and Sarsaul, respectively, who communicated their field problems to Kisan Sahayaks and SMSs & BDOs. The values of X2 indicate that significant difference in the communication of field problems to the extension personnel by the contact farmers. Rao and Reddy (1993) stated that the monthly workshop is the main venue of in service training for SMSs and of regular contact between extension and research workers.

6. Visit

A key feature of training and visit

Table: 6. Frequency of the visits of extension worker according to contact farmers

S. No.	Category	Kalyanpur		Sarsaul		Total	
		No of CFs	Per cent	No of CFs	Per cent	No of CFs	Per cent
1.	Regularly	16	53.33	8	26.67	24	40.00
2.	Occasionally	14	46.67	22	73.33	36	60.00
	Total	30	100.00	30	100.00	60	100.00
	Value of X^2	0.44		21.77***			

***Significant at 0.001 level of probability

Table: 4. Opinion of contact farmers about timely supply of irrigation

S. No.	Category	Kalyanpur		Sarsaul		Total	
		No of CFs	Per cent	No of CFs	Per cent	No of CFs	Per cent
1.	Untimely	18	60.00	16	53.33	34	56.67
2.	Timely	12	40.00	14	46.67	26	43.33
	Total	30	100.00	30	100.00	60	100.00
	Value of X^2	4*		0.44			

*Significant at 0.05 level of probability

Table – 4 reflects that 60 per cent contact farmers in Kalyanpur and 56.67 per cent in Sarsaul were of the opinion that the supply of irrigation water was untimely. The irrigation water has been unavailable when it is needed for the field and some available in ample amount when there is no need. 40 per cent contact farmers of Kalyanpur and 43.33 per cent of Sarsaul reported that irrigation supplied to them, is timely. The value of X2 reveals that there is significant difference in timely and untimely irrigation. Singh (1990) was observed that most of the contact farmers faced the problems of input regarding its cost, timely supply and quality . It was also found that the field problems were mostly identified by KSs and depending upon the severity of problems SDEOs/SMSs/Scientists visited the affected area for verification and identification.

Communication

Proper communication of field problems to the related officials and institutions is essential for the success of any programme.

It is clear from table- 5 that 56.69 per cent contact farmers of Kalyanpur block and 55.56 per cent contact farmer of Sarsaul block convey their field problems only to the Kisan Sahayaks. There were 23.08 per cent farmers in block Kalyanpur and 29.63 per cent of block Sarsaul who conveyed their field problems to

Table:5. Communication of field problems by contact farmers to different extension personnel

S. No.	Category	Kalyanpur		Sarsaul		Total	
		No of CFs	Per cent	No of CFs	Per cent	No of CFs	Per cent
1.	KSs/ AEOs	30	55.56	30	55.56	60	56.61
2.	KSs + SMS + SDEOs	12	23.08	16	29.63	28	26.41
3.	KSs + SMSs + BDOs	10	19.23	8	14.81	18	16.98
	Total	52	100.00	54	100.00	106	100.00
	Value of X^2	26.92***		25.53***			

*** Significant at 0.001 level of probability

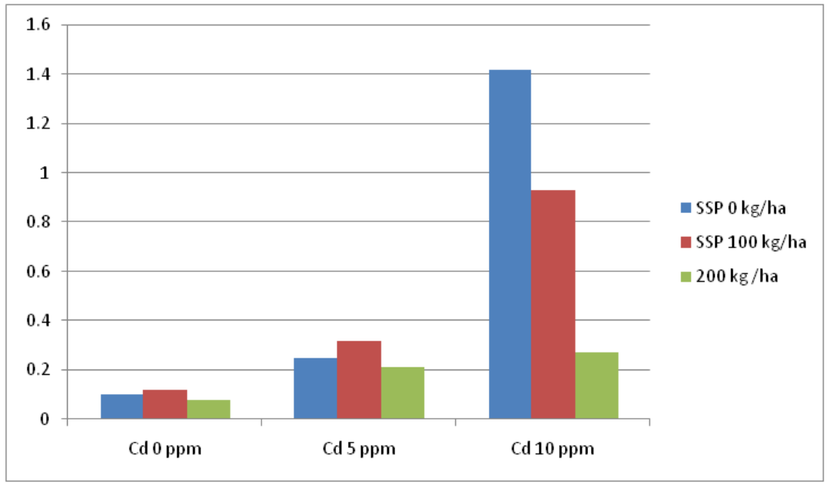

Fig. 3: Effect of Cd × SSP interaction on Cd concentration in root of *Brassica rapa L* (ppm)

Heavy metals are mobile and can be taken up easily by the plants. They occur in the soil in soluble form as salts (Bloemen et al., 1995). However, only soluble, exchangeable and chelated metallic species in the soil are mobile and in available form (Arambarri et al., 1999). Mobility is an important factor in regulating the availability and solubility of heavy metals in the soil and soil solution. The mobility depends on their speciation in the soil, which in turn depends on parameters such as organic matter and mineral composition, pH of the soil (Boisson et al., 1999). Mobility of heavy metals is also related to their immobilization in the solid soil. Metal accumulation in plant depends on plant species, growth stages and types of soil and metal, soil conditions, weather and environment (Zalidis et al., 1999).

CONCLUSIONS

Single super phosphate treated plots registered the highest shoot dry biomass and root yield of *Brassica rapa L* by 28.46% and 16.96% respectively. Application of SSP @ 200 kg ha-1 was found most effective in boosting the shoot dry biomass and root yield of Turnip. Cd @ 10 mg kg^{-1} influenced the shoot dry biomass and root yield diminutively, which was recorded 16.38 % and 3.42% decrease over the control plots, respectively in *Brassica rapa L*.

The reduced uptake of Cd was observed in single super phosphate treated plots. An ameliorative effect of single super phosphate was observed in Cd-contaminated soil. The results of presented study showed that single super phosphate can effectively immobilize Cd

in the soil. Single super phosphate has potential to reduce Cd accumulation in both root and shoot of the *Brassica rapa* L.

The application of single super phosphate to the soil possibly reduces Cd in the edible parts of the plants and helps to reduce the risk to the health of people living in metal contaminated areas. A more detailed study is required to grow *Brassica rapa* L or other vegetable crops in metals- contaminated areas and evaluate their growth and distribution of heavy metals in different edible parts of plants.

In view of the uncertainties that remain about the behavior and effects of Cd in the food chain, it is desirable to minimize its concentration in crops that are grown on sewage- irrigated soils.

As the uptake of Cd is reduced in presence of single super phosphate, a clear antagonism takes place. The addition of single super phosphate is bound to decrease the uptake of Cd by the *Brassica rapa* L.Where there is an access of industrial effluent rich in Cd, such amendments can be of practical value.

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Table:2. Classification of size of land holdings of contact farmers

S. No.	Category	Kalyanpur		Sarsaul		Total	
		No of CFs	Per cent	No of CFs	Per cent	No of CFs	Per cent
1.	1 -5 acres	10	33.33	8	26.67	18	30.00
2.	5 - 10 acres	15	50.00	14	46.67	29	48.33
3.	Above 10 acres	5	16.67	8	26.67	13	21.67
	Total	30	100.00	30	100.00	60	100.00
	Value of X^2	16.67***		8*			

*** Significant at 0.001 level of probability
*significant at 0.05 level of probability

both the blocks most of the farmers fall in the category of 5-10 acres i.e. 50 per cent in Kalyanpur block and 46.67 per cent in Sarasaul block. It is clear that the representation of all the categories is more proper in block Sarsaul than that of Kalyanpur.

3. Quality of seed

The quality of seed is an important variable for raising the crops. It is clear from table that 60 per cent contact farmers in Kalyanpur and 66.67 per cent contact farmers in Sarsaul were of the opinion that the quality of

Table:3. Opinion of contact farmers regarding the quality of seed.

S. No.	Category	Kalyanpur		Sarsaul		Total	
		No of CFs	Per cent	No of CFs	Per cent	No of CFs	Per cent
1.	Poor quality	12	40.00	10	33.33	22	36.67
2.	Good quality	18	60.00	20	66.67	38	63.33
	Total	30	100.00	30	100.00	60	100.00
	Value of X^2	4*		11.12***			

*** Significant at 0.001 level of probability
*significant at 0.05 level of probability

seed is good . 40 per cent farmers of block Kalyanpur and 22 per cent of Sarsaul reported about poor quality of seed. As for as overall opinion of farmers is concerned 36.67 per cent farmer have faced the problems of quality of seed in both the blocks. Value of X2 shows that there is significant difference in farmers' knowledge about poor and good quality of seed in Sarsaul block.

4. Irrigation

Irrigation is one of the important factor in crop production. The contact farmers were interviewed timely supply of irrigation.

for identification of field problems. Two blocks namely namely Kalyanpur and Sarsaul of distract Kanpur Nagar were selected for the purpose of investigation with the help of random sampling technique. Six groups of contact farmers were selected and each group of farmer have 10 farmers. Thus the total sample of contact farmers drawn was 60. Percentage and X2 test were used as statistical measures for calculation of data.

RESULTS AND DISCUSSION:

1. Social Participation :

For the purpose of study, social participation was defined as the voluntary sharing in person to person and group to group relationship beyond the immediate household.

Table: 1. Social participation of contact farmers

S. No.	Category	Kalyanpur		Sarsaul		Total	
		No of CFs	Per cent	No of CFs	Per cent	No of CFs	Per cent
1.	Member of one organization	16	53.33	19	63.33	35	58.33
2.	Member of more than one organization	14	46.67	11	36.67	25	41.67
	Total	30	100.00	30	100.00	60	100.00
	Value of X^2	0.44		7.108*			

**Significant at 0.05 level of probability*

Table 1 reveals that 53.33 per cent contact farmers were the members of one organization and 46.67 per cent contact farmers were the members of more than one organizations in block Kalyanpur. In Sarsaul 63.33 percent contact farmers belong to member of one organization as compared to 36.67 per cent contact farmers belonging to more than one organizations. The average participation of contact farmers of both the blocks shows that 58.33 per cent contact farmers are associated to one group as compared to 41.67 per cent having association with more than one group. The value of x2 shows That the system had significant impact on the level of social participation of contact farmers of Sarsaul block. M.N. Reddy and P.G. Reddy (1992) remarked that for developing messages active participation of farmers, field level workers and scientists is essential.

2. Size of land holding

Size of land holding refer to the land unit owned by a farmer under possession. Table 2 depicts that out of selected respondents the minimum of 16.67 per cent fall in the category of farmers holding above 10 acres in block Kalyanpur and 26.67 percent of the farmers belong to the same category in block Sarsaul. In

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EFFECT OF TRAINING AND VISIT SYSTEM ON THE FARMERS OF KANPUR, UP

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ABSTRACT

Continuous up gradation of knowledge and latest training of extension personnel and its regular contact with the farmers regarding solution of farm problems is highly essential at grass root level. T and V system applies this mechanism very effectively. The present study found that farmer of the selected area were capable enough to diagnose their farm problems due to the efforts of T and V system . sometimes they take support of extension officers/ scientist in diagnosis of some innovative problems prevalent at their farms. Extension workers, officers of state govt. also visited the farmers field frequently and provide necessary support whenever it was realized by the farmers.

Key Words: Subject matter specialist, training and visit, contact farmers, transfer of technology, kisan sahayak, sub divisional extension officer.

Indian economy is basically an agrarian economy and a major source of employment to the rural people especially landless rural Indians. Despite sustained efforts in agriculture and spectacular strides made in agricultural technology over the past several decades. India is still faced to a challenge that was to be viewed in light of rapidly growing population and the gradual depletion of natural resources in the form of land and water available for agriculture in coming decade.

The transfer of technology in agriculture development has generally being directed towards increased physical production from farms and reducing cost to farmers. The origin of this concern for the rural people stemmed in part from the realization that the traditional transfer of technology processes were mainly benefiting those farmers who have superior resources. The training and visit system developed by Israeli expert Daniel Benor who worked in Turkey since 1970 and helped the countries to adopt the system. The basic features of the worldwide appreciated system was training of village level workers by subject matter specialist and continuous visit by the village level workers for proper guidance to the farmers field for whole season.

MATERIALS AND METHODS

The study was based on the descriptive diagnostic type of research design. Office bearers and contact farmers were interrogated

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EFFECT OF SOURCE AND STORAGE INTERVAL ON pH CONTENT OF SHRIKHAND

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ABSTRACT

The ten treatment combinations (5 sources and 2 temperature) of Shrikhand were evaluated to study the effect of source and storage interval on pH of Shrikhand. The results obtained revealed that the pH of Shrikhand was differing significantly between manufacturers. Similarly the pH of OSM Shrikhand from both the cities was found significantly more over that of laboratory Shrikhand. A relatively higher pH value 4.46 was observed for laboratory prepared samples which differ significantly from market samples. The pH values of market samples were 4.01, 3.78, 4.03 and 3.91 in OSM Akola, Akola vendors, OSM Amravati and Amravati vendor respectively. The differences were found non significant. Generally, the market traders had a tendency to produce high acidic Chakka to accommodate more amount of sugar with the view to earn more profit.

Key words : Shrikhand, storage pH

Shrikhand is a protein and fat rich indigenous fermented semisoft milk product. It has refreshing taste, pleasing aroma, smooth homogenous texture and firm consistency. Now it is most popular in Maharashtra, Gujarat, M.P., Karnataka and some part of Rajasthan. Shrikhand is a popular indigenous cultured milk product made from Chakka. It is an analogue at western 'Quarg' which has therapeutic value like other fermented milk products. The popularity of this product having a status of summer specialty, served as a desert on ceremonial functions is mainly attributed to its refreshing taste, cooling effect and lowest cost. During summer season a fairly large quantity of Shrikhand is manufactured by the dairy shops and restaurants by conventional process (Upadhyay and Dave, 1977). The reputed dairy industries like Amul, Arey and Warna entered into the manufacturing of the Shrikhand. Everyday tones of Shrikhand are prepared and marketed all over Maharashtra.

The pH plays an important role in keeping quality of Shrikhand, which also depends on the method of preparation and initial microflora like, bacteria, yeast and moulds and other contaminants. Despite containing as high as about 50% sugar in Shrikhand, the product is known to develop off flavour and odour under commercial condition of storage. Shrikhand is now being manufactured by organized dairies and hence experiment was conducted to study the effect of source and storage interval on pH of Shrikhand.

MATERIALS AND METHODS

The present study was carried out in five replications at Department of Animal Husbandry and Dairy Science, Dr. PDKV, Akola and Shri. Shivaji Agriculture College, Amravati during 2007-2008. The cities selected were Akola-C1 and Amravati-C2 from Vidarbha region of the Maharashtra state where fairly large quantity of Shrikhand is prepared everyday and marketed in and around the city. The samples collected from the market and prepared in the laboratory were stored at room temperature (30 $\pm$ 2^{0}C) and at refrigeration temperature (5 $\pm$ 1^{0}C). The samples stored at room temperature were analyzed at an interval of seven days till thirty five days when it got spoiled. Thus the following treatments were formed in the study.

A) Type of sample source

C_1S_1	Akola organized sector Manufacture (OSM)	T_1	Room temperature (30$\pm$2^{0}C RH 50 to 70%)
C_1S_2	Akola vendor		
C_2S_1	Amravati organized sector Manufacture (OSM)	T_2	Refrigeration temperature (5$\pm$1^{0}C RH 85%)
C_2S_2	Amravati vendor		
LS_3	Laboratory		

B) Storage temperature

Thus, there ten treatment combinations (5 sources x 2 temperature) on which the storage study was carried out in five replications.

pH of Shrikhand was determined by adding equal volume of distilled water to 10 g of sample and was mixed thoroughly. pH was determined using pH meter.

The data collected from the study was analyzed under complete factorial randomized block design (CFRBD) with three factors i.e. type of city, sources of collections and storage temperature as per procedure describe by Amble (1975).

RESULTS AND DISCUSSION

The results on pH of the Shrikhand during storage presented in Table 1 to 4. The results depicted in tables revealed that source of Shrikhand storage interval and their interaction affected significantly the pH of Shrikhand. The pH values showed a significant decrease from 4.04 to 3.32 in 5 days storage irrespective of source and storage temperature. This means with the increase of TA there was decrease in pH. Similar observations were noticed by Karthikeyan *et al.* (2001).

The interaction between source and storage temperature influenced significantly on pH of the Shrikhand [Table 2]. The pH values in all sources of Shrikhand samples were significantly lowered when stored at 30$\pm$2^{0}C than the samples pH content stored at 5$\pm$1^{0}C. The pooled average for pH values irrespective of the source and storage interval was 3.53 and

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Table 2: Effect of phosphorus and boron butrition on the grain yield of chickpea (kg ha^{-1})

Treatments B/P	Yield			
	P_0	P_1	P_2	Mean
B1	1103	1207	1224	1178
B2	1101	1219	1235	1181
B3	1104	1228	1405	1264
B4	1116	1412	1429	1319
Mean	1106	1267	1321	1231

Comparison	SE±	CD 5%
B	3.51	7.10
P	3.24	6.12
PxB	6.08	12.25

Table 3 : Residual fertility status of soil in respect of P and B after the crp.

Sl.	Treatments	Available P (kg ha^{-1})		Available B (mg kg^{-1})	
		Before crop	After crop	Before crop	After crop
1	B_0 P_0	6.90	6.70	0.34	0.32
2	B_0 P_1	7.00	7.12	0.33	0.33
3	B_0 P_2	7.00	7.49	0.34	0.34
4	B_1 P_0	7.12	7.14	0.35	0.37
5	B_1 P_1	6.89	7.90	0.34	0.34
6	B_1 P_2	7.00	7.87	0.34	0.38
7	B_2 P_0	7.01	7.15	0.35	0.41
8	B_2 P_1	7.02	8.00	0.33	0.41
9	B_2 P_2	7.31	8.12	0.33	0.45
10	B_3 P_0	6.89	7.44	0.34	0.46
11	B_3 P_1	7.88	7.13	0.35	0.46
12	B_3 P_2	7.01	8.05	0.35	0.48

Table 1: Effect of source and storage interval on pH content of Shrikhand at both temperature (T_1 and T_2)

Storage interval (Days)	Source of Shrikhand					Days pooled means
	C_1S_1	C_1S_2	C_2S_1	C_2S_2	LS_3	
1	4.00	3.77	4.02	3.96	4.46	4.04
2	3.89	3.58	3.84	3.80	4.33	3.89
3	3.64	3.38	3.56	3.55	4.20	3.67
4	3.48	3.22	3.21	3.34	4.09	3.47
5	3.36	3.06	2.99	3.23	3.97	3.32
Pooled means (s)	3.67	3.40	3.52	3.58	4.21	

Attribute	Source	Storage interval	Source X Storage interval
Results	Sig.	Sig.	Sig.
SE(m) ±	0.028	0.028	0.064
CD at 5%	0.080	0.080	0.179
CV %	5.56		

Note : C_1S_1 - Akola OSM, $C1S_2$ – Akola vendor, C_2S_1 – Amravati OSM, C_2S_2 – Amravati vendor and LS3 – Laboratory Shrikhand T_1 – 30 ± 2^{0}C, T_2 – 5 ± 1^{0}C

3.82 at 30±2^{0}C and 5±1^{0}C respectively. The differences were found significant. This means the storage at lower temperature was advantageous to control to development of

Table 2 : Combined effect of source and storage temperature on pH content of Shrikhand

Source	T_1	T_2
C_1S_1	3.49	3.86
C_1S_2	3.16	3.64
C_1S_2	3.50	3.55
C_2S_2	3.41	3.74
LS_3	4.10	4.31
Temp. pooled means	3.53	3.82

Table 3 : Combined effect of storage temperature and storage interval on pH content of Shrikhand

Days	T_1	T_2
1	4.04	4.04
2	3.83	3.95
3	3.51	3.83
4	3.24	3.70
5	3.05	3.59

Attribute	Storage Temp.	Source X Storage Temp.	Storage Temp. X Storage interval
Results	Sig.	Sig.	Sig.
SE (m) ±	0.018	0.040	0.040
CD at 5%	0.050	0.113	0.113
CV %	5.56		

acidity as well as, the microbial activity.

However, the results of Table 3 in respect of combined effect of storage temperature and storage interval on pH content of Shrikhand revealed that the pH values showed steady decrease with increase in storage period at both the temperatures. The rate of decrease was higher at 30 ± 2^0C than at 5 ± 1^0C. decrease with increase in storage period at both

Table 4 : Effect of source and storage interval on pH content of Shrikhand at 5 ± 1^0C

Storage interval (days)	Source of Shrikhand					Days pooled means
	C_1S_1	C_1S_2	C_2S_1	C_2S_2	LS_3	
Fresh	4.00	3.77	4.02	3.96	4.46	4.04
5^{th} day	3.71	3.51	3.05	3.54	4.14	3.59
7	3.63	3.44	2.97	3.48	4.04	3.51
14	3.41	3.16	2.74	3.25	3.88	3.29
21	3.23	2.91	2.55	3.00	3.69	3.08
28	3.04	2.73	2.33	2.80	3.50	2.88
35	2.84	2.54	2.15	2.62	3.32	2.69
Pooled means (s)	3.23	2.96	2.55	3.03	3.69	

the (table-2) that grain yield was also increased due to 1181 to 1319 kg ha^{-1}, A combined dose of 60 kg ha^{-1} phosphorus (P_2O_5) and 2.00 ppm boron save the highest growth and yield. There study was to analyse the composite soil sample for phosphorus and boron before and after the crop. A comparison of two sets of soils indicated the residual status of soils of chitrakoot. It was evident from data (Table-3) that initial soil before fertilization contained available P between 6.90 and 7.31 Kg ha^{-1}. Similarly available boron status varied between 0.33 to 0.35 mg kg^{-1} soil. The soil of experimental field had low available P and B. After the harvest the data showed that even after growing of crop the residual fertility appeared to be built up rather than the lowering of values compared to original soil (Unfertilized control). Available P varied from 6.70 to 8.12 kg ha^{-1} soil. The highest value of available P was recorded in B3P1 (7.88) closely followed by B2P2 (7.31).

Similarly the highest available boron was recorded B_3P_2 (048 mg kg^{-1}). In case of unfertilized soil before crop the ranges of variation for P and B varied from 6.89 kg to 7.88 kg ha^{-1} and 0.33 mg to 0.35 mg kg ha^{-1} soil. Thus it was clear that applied doses of P and B were sufficient amounts of nutrients for built up to fertility for supporting the future crop. The results of this study are in consonance with those of Reddy and patil (1980), Singh et al., (1988) and Brady (1995).

Table:1- effect of phosphorus and boron on growth, root nodules and yield of chickpea

Treatments	Lenght of root (cm)		No of leaves per plant		No. of root nodules per plant		Plant height (cm)		Grain yield
	25DAS	50 DAS	25 DAS	50 DAS	25DAS	50 DAS	25DAS	50 DAS	
B_0	7.7	14.0	13.5	15.3	1.8	7.45	17.8	27.4	1178
B_1	7.4	14.0	13.6	16.6	1.6	8.47	17.7	28.7	1181
B_2	7.9	14.5	14.6	19.7	2.1	10.40	17.7	24.4	1264
B_3	7.9	14.0	14.5	18.9	1.5	9.70	18.1	27.3	1319
SE±	0.36	0.64	0.356	0.402	0.45	0.363	0.344	0.556	3.51
C.D. at 0.5%	NS	NS	0.775	0.835	NS	0.711	0.677	1.140	7.10
P_0	7.6	14	12.4	15.6	1.8	8.4	16.4	24.4	1106
P_1	8.1	14	15.2	17.6	1.9	8.8	18.4	27.8	1267
P_2	7.4	14.5	18.5	19.7	1.5	9.1	18.5	28.9	1321
SE±	0.33	0.66	0.315	0.374	0.35	0.306	0.276	0.490	3.24
C.D. at 0.5%	NS	NS	0.677	0.775	NS	0.616	0.552	0.987	6.12

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setting and translocation of sugars and starch, phosphorus amino acids and nodule formation. Boron regulates the metabolism of phenols, carbohydrates, IAA and RNA. Boron content of Indian soils varies from 16 ppm to 630 ppm with an average of 38 ppm, but Berger and Trong available B is very small. High boron content is found in arid and semi-arid soils, particularly in salt affected soils. Boron deficiency is of wide occurrence in soils of Bihar, Karnataka, Madhya Pradesh, U.P. and W.B. (Tandon, 2002). The plants heavily fertilized by NO3 and PO4 also require high amounts of boron. From the foregoing account is it clear that P and B nutrition of pulses is important for satisfactory yield and quality of chickpea under rainfed situation.

MATERIALS AND METHODS

Field experiment was conducted at Research farm Rajaula of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot Satna (M.P.) India during Rabi season with chickpea (Var. Aurodhi) in the year 2010-11. The experimental sand 56.50, silt 26.53 and clay 26.97%, textural class sandy loam and soil had pH 8.0, EC 0.27 dSm^{-1} Organic carbon 0.38, 148 Kg ha^{-1} available nitrogen, 7.08 kg ha^{-1} available P, 170 Kg ha^{-1} available K_2O and 0.33 ppm available boron. The treatment consisted of three levels of each phosphorus (0, 40, and 60 kg ha^{-1}) and boron (0, 0.5,1.0 and 2.0 ppm) and were laid out in factorial randomised block design with five replication. Phosphorus were applied as basal dressing through DAP and boron spraying through borax as per treatment respectively. An uniform application of nitrogen and potash @ 20 and 40 kg ha^{-1} was made as basal dressing through urea ans muriate of potash, respectively. Seeds were sown at 45 cm distance in the third week of October during the year 2010. The length of root, number of leave per plant, number of root nodules per plant, plant height before harvest of crop were recorded at 25 and 50 days after sowing and grain yield were recorded after harvest of crop. The soil of experimental field was analyzed as per standard procedures. Available phosphorus extraction from soil was done by Olsen's method (olsen et al., 1954). Phosphorus was estimated by Vanadomolybdate yellow colour method (Jackson 1973) and available B was estimated by the method of Berger and Troug (1940).

RESULTS AND DISCUSSION

Growth and Nodulation studies:-

The result revealed (Table-1) that growth of chickpea attained significantly higher growth characters viz. length of root, number of root, number of leaves per plant, number of root nodules per plant, number of plant height due to application of phosphorus and boron. These all growth significantly 7.9, 14.1, 1.7, 17.8 also recorded 25 DAS and 14.2, 17.6, 9.02, 27.0 were recorded 50 DAS. The average mean value of the growth and root nodules 29.03 were also recorded. Since both the nutrients have important role in protein synthesis which, in turn is responsible for increased leaf number (Das, 1999, Begum, 2007). Ashokan and Raj (1994) reported that increased level boron fertilization promoted increased plant height in groundnut. Out results are in agreement with the findings of above workers. These abserved from

Attribute	Source	Storage interval	Source X Storage interval
Results	Sig.	Sig.	NS
SE (m) ±	0.046	0.046	0.105
CD at 5%	0.130	0.130	-
CV %	7.61		

Note : C_1S_1 - Akola OSM, C_1S_2 – Akola vendor, C_2S_1 – Amravati OSM, C_2S_2 – Amravati vendor and LS_3 – Laboratory Shrikhand

the temperatures. The rate of decrease was higher at 30 ± 2^0C than at 5 ± 1^0C.

Moreover, the results with regards to pH content of Shrikhand on extended storage for 35 days at 5 ± 1^0C are tabulated in Table 4. It was noticed that there was significant decrease in pH of the Shrikhand with the increase of storage period. The initial pH value irrespective of source of the Shrikhand was 4.04 which reduced to 3.59 in 5 days of storage at 5 ± 1^0C and the further decreased to 2.69 in 35 days storage. However, the rate of decrease in pH values with the progress of storage interval was dependent on the initial pH of the Shrikhand. As the interaction between source and storage interval was non significant while, source of the Shrikhand influenced significantly on pH values.

Similar trend has been reported by Sharma and Zariwala (1980) and Upadhyay et al. (1985) in Shrikhand during storage. They further reported that the increase in acidity and decrease in pH could be attributed partly to the increase in number of acid producing organisms and also to continued acid producing ability of the cells which were inactivated. Similarly, Upadhyay et al. (1985) cited that decrease in moisture level of the product may be one of the factor responsible for apparent increase in acidity values and decrease in pH. These reasons support the present results as there was decreased in the moisture level from the initial value with increase of the storage interval.

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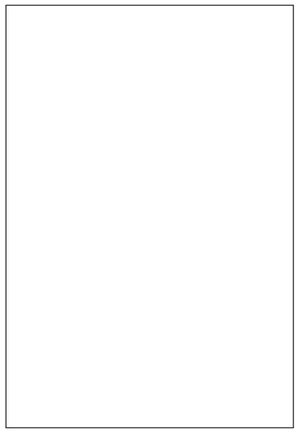

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DAIRY HUSBANDRY KNOWLEDGE: ANTECEDENT FOR HIGHER MILK PRODUCTIVITY AMONG TRIBAL WOMEN.

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ABSTRACT

Present research was conducted to identify if knowledge of dairy husbandry has an effect on milk production of milch animals. Data was collected from women dairy co-operative members of Dangs district (a tribal area) for possessed animal husbandry knowledge and its effect on milk productivity. Regression analysis found knowledge of dairy husbandry is positively associated with milk production and the relation predicts an increase in knowledge of dairy husbandry would lead to increased milk productivity and higher earned income.

Key words: Milk productivity, knowledge, association.

"India lives in its villages" - Mahatma Gandhi.

The above quote from Mahatma Gandhi points out to the importance of rural villages along with an impact they could have on the growth of Indian economy. The significance and validity of visionary statement lies in the fact that currently, 833 Million citizens (i.e. 68.84% of Indian population) reside in geographical areas categorized as “villages” by Indian government. Interestingly, rural sector plays a significant role in India's economic development by accounting for 29 percent of Indian gross domestic product (GDP). Majority of people in villages depend on agriculture and allied sectors for livelihood and other possible economic activity (Singh 1999).

One of the major contributors to the rural development is the augmentation of dairy co-operatives where farmers under a special business model participate in dairy business as a member and as an owner of the business. A study conducted by Shiyani (1996) compared the difference in milk productivity between co-operative members and non- members. The research found a significant difference in milk productivity with members on average producing around 29.96 percent higher milk than non-members. Detailed analysis found that difference in milk production was 21.9 percent in winter, 32.68 percent summer and 16.44 percent in monsoon with member of co-operatives having higher milk production. Additional evidence on the same lines was reported by Anjani Kumar et. al., (2013). They

collected data from the Indo Gangetic plain of India and reported that dairy co-operative members had higher level of farming and adopted improved animals more than non-members.

Given these findings, an interesting question then is, why is there such a huge difference in milk productivity between co-operative members and non-members? The objective of this research is to study the effect of knowledge possessed by members' on milk productivity. If knowledge has positive effect on milk productivity, it could lead to better income for rural village population and their overall development.

THEORETICAL FRAMEWORK

Rural development is an interesting and complex construct as it cannot be defined by a single goal; rather it has been characterized by multiple goals. There tends to be no single index or indicator which can adequately capture the multifaceted nature of rural development. Currently, natural resources, employment, capital, technology and organization and institutional framework are identified to be contributors to rural development index Singh , (1999). Dairy co-operatives tend to have a positive impact on majority of these parameters as co-operatives brings in employment, institutional framework, technology and helps in efficient use of available natural resources.
Meena et. al., (2009) reported evidence that dairy cooperatives had an impact on income and employment generation of milk producers in Rajasthan and the average net income of members was significantly higher (Rs. 13,285.30) than non-members (Rs. 3,602.75). Singh (2013) went a step further and found that involvement in dairy business through co-operatives has significant positive impact on latent construct of empowerment. One of the major findings of this work was that involvement in dairy business activities mediates felt empowerment in tribal women. The project reported the data for women involved in dairy business had more earning capacity with higher disposable income and had more involvement in house hold purchase decisions but the most interesting finding was the association between income generated through dairy business and the felt empowerment (which is a latent variable). Given these findings it could be presumed that there is something which comes in with dairy co-operatives that leads to higher milk productivity.

Dairy co-operatives tend to bring with them good amount of technical knowledge, especially animal husbandry knowledge and through extension activities this knowledge gets transferred to members. Therefore, objective of this research is to identify if higher knowledge possessed by members leads to higher milk production. Hence, the first hypothesis for this project is higher animal husbandry knowledge would lead to higher milk production.

ANIMAL HUSBANDRY KNOWLEDGE

Milk production tends to depend on timely feeding and management i.e. preventive

health care and hygiene practices adopted by dairy farmer. Judicious use of inputs and adoption of good management practices at farm level probably improves milk production which could profit dairy farmer and probably would lead to sustainable dairying business. Providing adequate water, balance feed, feed additives along with preventive care such as de-worming, vaccination and with adoption of good livestock management practices, milk production can be boosted. Garg (2012) reported that milk productivity could be enhanced for dairy animals through balanced feeding. Additionally, he argued milk production could be enhanced with existing feed and animal resources. Verma et. al., (2009) reported increase in milk production and fat percentage in lactating buffaloes with feeding of cattle feed supplement rich in protein and minerals. Implementation of successful de-worming program for overall good herd management. Additionally, immunizations are essential for effective health care of milch animals as vaccinations tend to prevent diseases and reduce contagious spread of disease (Suttmeier, 2003).

Given the fact that all of the above mentioned factors are equally essential for better care of milch animals, water tends to serve as one of the primary necessity because all living organisms need water to survive. Evidence suggests that adequate supply of drinking water to dairy cattle is important for quality milk production and farmers typically provide access to quality drinking water for twenty-four hours (Adams 1995 and McFarland, 1998). An average of forty one liters of drinking water is required per day for dry cows and one hundred fifteen liters of drinking water is necessary per day for milking cows (Adams 1995 and McFarland, 1998). Hence, for this research, knowledge about water feeding is considered as an important animal husbandry knowledge predictor for two reasons. First, different variables would impact the milk production of cows and using all the indicators at once would need the formation of a knowledge index which probably could reduce the parsimony of research. In order to have higher parsimony, possession of water feeding knowledge is independently tested for possible effects. Second, majority of research seems to have been conducted in richer demography having access to higher education and higher access to natural resources such as water and feed. This research tends to focus on tribal area where education level tends to be low with harder access to resources for animal rearing. This is more conservative test for hypothesized effect. Thus, second hypothesis for this research is that possession of higher knowledge about water feeding would lead to higher milk production. Additionally, higher milk production would lead to higher income.

SPECIFIC HYPOTHESIS

Three specific hypotheses for this research are described below. To have brevity only the alternative hypothesis are mentioned. Null hypothesis for all H1, H2 and H3 would be, there is no effect for each.

H1: HIGHER ANIMAL HUSBANDRY

KNOWLEDGE LEADS TO HIGHER MILK PRODUCTION.

H2: HIGHER KNOWLEDGE ABOUT WATER FEEDING WOULD LEAD TO HIGHER MILK PRODUCTION

H3: HIGHER MILK PRODUCTION LEADS TO HIGHER INCOME.

MATERIALS AND METHODS

Sampled Area

Dangs is one of the smallest districts under jurisdiction of Gujarat state and has only three talukas with three hundred eleven villages. Geographically, Dangs is surrounded by the Maharashtra state from east and south where as on northern and western side, Surat and Navsari districts are adjacent to it. Dangs is on hilly terrain with dry climate in winter (i.e. till the month of March) followed by humid climatic conditions and monsoon probably lasts till the month of October. The soil quality is considered poor and not suitable for agricultural activities. Majority of the population (around 94 percent) are tribals and major source of livelihood tend to be seasonal labor in sugar factories, construction work and unskilled farm work in the nearby towns of Surat, Navsari etc. Recently, dairy husbandry has started to pick up as a profession for livelihood in Dangs due to incoming of dairy co-operatives. People in Dangs face many difficulties due to tough geographic conditions and the district is located far away from main cities. Dairy co-operatives have recently started to operate in the area and so observed effect in knowledge about husbandry would be attributes to dairy co-operatives.

Sample Selection

Stratified random sampling technique was adopted to select fifteen village dairy cooperatives out of one hundred fifty village dairy cooperatives currently functioning in Dangs. A total of two hundred fifty two respondents were randomly selected out of seven hundred thirty four members from these fifteen village dairy cooperatives. Appropriate measures were adopted to maintain representativeness of each village (i.e. a range of thirty to forty percent of total membership from each village dairy cooperative) from fifteen village dairy co-operatives.

Data Collection

A questionnaire was created and administered to measure the knowledge level of subjects. Water knowledge measure was measured through multiple choice question asking how many times water should be fed to cows (responses being: do not know, once a day, twice a day, thrice a day, four times a day and twenty four hour supply). Other demographic information was also collected. Annual income, monthly income and number of cows possessed was collected from the records available with the dairy co-operatives.

RESULTS AND DISCUSSION

Data Analysis

Response to knowledge measure was coded for correct response and incorrect response. Technically, during the training program by dairy co-operatives, members were informed that water should be made available to

milch animals for twenty four hours. Hence, responses for twenty four hour supply was coded as 1 indicating correct response and rest all the responses were coded as "0" indicating wrong response.

Some participants had only one cow while others had more than one. The annual income was standardized to only one cow (i.e. each participant's annual income was standardized for one cow) in order to facilitate analysis through constant base-rate for number of cows. After base-rate standardization, annual income was converted to monthly income for analysis. Given that independent measure was on dichotomous scale (1= knowledgeable and 0 – not knowledgeable) and dependent measure was monthly income in rupees, a natural log transformation was done to dependent measure for conducting analysis.

A simple linear regression model (SLR) was fitted (using SPSS 22) with natural log transformed income per cow as dependent measure and knowledge about water feeding as independent measure. The analysis found a significant relation between knowledge about water feeding and income generated. Equation-1 shows the fitted regression model and Table 1a, 1b report the coefficients and probability values for them respectively. The analysis revealed that knowledge about water feeding is positively associated with the income generated in such a way that one unit increase in water feeding knowledge would lead to an increase of 0.17 in log income of the farmer. In other words, knowledge about water feeding is positively associated with income generated.

Fitted Regression Model- Knowledge of water as predictor:

Generic simple linear regression model is expressed as below

$$y = \beta_0 + \beta_1 x + \varepsilon$$

The fitted simple linear regression model is below

$$Ln(Income) = 10.31 + 0.17\,KW + \varepsilon \qquad (1)$$

Where;

Ln(Income) = Natural log of income per cow

KW = Knowledge about cow water feeding

ε = Error (variance not accounted)

Data analysis supports the entire three hypotheses. It is found; a member possessing

Table 1a: Coefficient of Fitted Regression Model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.310	.045		227.751	.000
	Knowledge about water	.170	.077	.137	2.191	.029

a. Dependent Variable: ln_income_per_cow

Table 1b: Probability value for Regression

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.633	1	1.633	4.801	.029[b]
	Residual	85.042	250	.340		
	Total	86.675	251			

a. Dependent Variable: ln_income_per_cow

b. Predictors: (Constant), Knowledge about water

correct information about the number of times water is needed to be fed to milch animals is positively associated with amount of milk produced and the income generated. Dairy co-operatives tend to pay on quality-quantity formula meaning same quality and same quantity of milk would have same income. The results show that those members who didn't have proper knowledge earned significantly lesser income than those members who had right knowledge about water feeding (β_i= .17, p = 0.02). This shows that possession of knowledge about dairy husbandry significantly increases the amount of milk produced and income earned.

CONCLUSION

This research provides evidence that knowledge of dairy husbandry tends to have a significant positive impact on milk production of milch animals. Results show that co-operative members tend to have overall better knowledge and even between the members, those who possessed correct knowledge about water feeding tend to have higher milk production with higher quality and therefore, earned more. This finding has a significant impact as effect of latent knowledge is measured and analyzed empirically. These findings also suggest that extensive extension activities from dairy co-operatives, agricultural universities and experts tend to have positive impact on milk production. Therefore, extension activities need to continue. Future research could study how other knowledge variables i.e. knowledge about cattle feed, vaccination or de-worming affects milk production.

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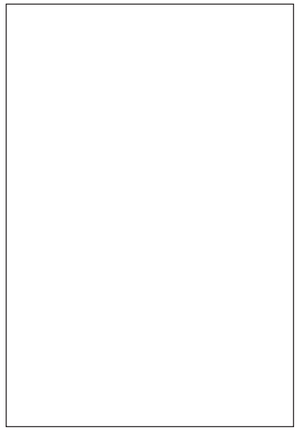

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ANALYSIS OF WEED COMMUNITY OCCURRING IN WHEAT CROPLANDS AND ITS IMPACT OVER WHEAT CROP PRODUCTION

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ABSTRACT

Studies have shown that weed invasion into various ecosystems may be suppressed if the resident plant community is sufficiently diverse. The objective of this study was to determine whether increased crop plant diversity in cropland communities might be associated with reduced weed abundance in studied cropland ecosystems. This study is based on diversity of weeds of rabbi (wheat) crop fields, which provides a preliminary data of the different categories of weeds commonly found in wheat cropland ecosystems which will be helpful to identification of wheat weeds and their specificity. Further study is required for distribution and quantification of weeds for ecological management.

During present course of investigation seven dominantly inhabiting wheat weeds appeared during a wheat cultivation cycle were studied and characterized.From the study site (wheat cropland) in Lucknow region, the observed weeds belong to six different families belonging to monocots and dicots. In floristic survey, *Phalaris minor Retz.,Avena fatua L.,* and *Cyperus rotundus L.* were found to severely inhibit the growth yield of our economically important wheat crop by releasing some chemicals that have adverse effect over growth and development of wheat crop. Due to weeds competition, many tillers wither before earing stage. Ears get shortened due to prolonged competition, less number of grains and less weight of grains. The weed seeds get admixture in the crop seed and reduce grain quality. Our results suggest that maintaining an evenly distributed crop plant species may help suppress weeds as well.

Key Words: Weed, IVI, diversity index, allelopathy, percent germination, dry biomass,

Weeds are one of the major problems in crop production. Major weeds in winter grain crops in India are Broad leaved weeds like Lamba quarters *(Chenopodium sp.)* and wild safflower *(Carthamus oxyacantha)*. In some parts of the country where perennial dicot weeds viz., Canada thistle *(Cirsium arvensis)*, Field Bind Weed *(Convolvulus arvensis)* are found, there are some annual grasses like wild oat (Avena fatua), Canary grass *(Phalaris minor)* etc. are also commonly noticed. Weed interference is one of the most important factors

to decrease the yields of wheat (Hassan and Marrwat, 2001). Weeds are undesirable on account of their competitive and allelopathic behavior and providing habitats for harmful organisms (Zaman et.al., 2011). They compete with crop plants for light, moisture, nutrients and space (Almaghrabi, 2012). Invasive weeds in pastures reduce forage quality and yield, impair animal performance, and increase management costs associated with herbicide application and pasture renovation (DiTomaso, 2000). A way to reduce weed abundance in pastures may include maintaining diverse assemblages of resident forage plants. Many experiments have reported reduced weed abundance with greater resident plant diversity in grasslands (Knops et.al. 1999; Hector et.al.2001; Pfisterer et.al. 2004).

A reduction of weed abundance in diverse plant communities may occur (Wardle, 2001) by two general mechanisms: (1) 'Resource use complementarity', where the different species in a community complement each other in their resource use and create a strong competitive environment that is difficult for weedy plants to invade, and (2) the 'sampling effect' caused by the increased probability that a more diverse community will have at least one productive species that reduces available resources and suppresses weed abundance. Resource complementarity is a true 'diversity effect' in that interactions among multiple species in a diverse community help suppress weeds. The sampling effect is not a true diversity effect since weed suppression results from a strong competitive environment created by one species, not the interaction among multiple species.

Increased vegetation diversity may have other indirect beneficial effects on agroecosystems. For example, increased vegetational diversity can lead to suppression of pests via 'top-down' enhancement of natural enemy populations or by resource concentration and other 'bottom-up' effects acting directly on pests (Gurr et.al., 2003). Similarly, Knops et.al.(1999) found reduced leaf pathogen abundance with greater plant diversity in grassland plots. Some studies also suggest there may be tighter nitrogen cycling and less nitrate leaching with increased diversity in grasslands (Scherer-Lorenzen et.al., 2003). Overall, maintaining diversity in agro ecosystems may help improve crop yield or quality and increase the sustainability of the farming system.

The word biodiversity is primarily associated with the diversity of living organisms, meaning the abundance of different animal, plant and microbial species. Biodiversity is usually plotted as taxonomic richness of a geographic area, with some reference to a temporal scale. Whittaker (1972) described three common metrics (Species richness, Simpson index, Shannon-Wiener index) used to measure species-level biodiversity, encompassing attention to species richness or species evenness.The number of species per sample is a measure of richness. The more species present in a sample, the richer the sample. Evenness is a measure of the relative abundance of the different species making up the richness of an area.

There are two important aspects to the

relationship between weed invasions and biodiversity monitoring . The first concerns the need to monitor how biodiversity responds to weed invasions and the second how the occurrence, distribution and abundance of weeds could be used as an indication of biodiversity. Weed invasion is a major threatening process for biodiversity, it will be valuable to document the occurrence, distribution and abundance of alien plant species as part of biodiversity monitoring program. Weeds are having impacts on biodiversity in general as well as at individual sites. An important reason for collecting such data should be to help make decisions about directing resources at weed management in order to slow, halt or reverse biodiversity decline (Grice, 2000). In this contest, it is however of basic importance to define the term community as all the organisms in a delineated study area belonging to the taxonomic group of interest (Pielou, 1977). The primary aim of scientific analysis on ecological diversity is to formally define the concept of diversity and subsequently quantify diversity by means of suitable indices.

Some weeds are specific for the particular crop fields only. Before going to make any decision about a solution to a problem as mentioned in objective of the present investigation we need to survey, identification and documentation of the weed diversity and also to visually confirm the existing situation of wheat field. The observed weeds were further screened to get their influence over wheat crop's growth, development and biomass production.

MATERIALS AND METHODS

1- Assessment of Weed Community Inhabiting Wheat Cropland Ecosystem

Various weed species of the wheat cropland commonly observed during present course of investigation were recorded by taking sampling unit i.e., quadrat size of $1\times1m^2$ and then their ecological characterization and taxonomic evaluation with phytoconstituents present in particular weed species along with its impact over biological system were also studied. Community analysis of seven dominating weed species appeared in study area was performed and represented in terms of IVI (Importance Value Index) and Index of Dominance (Diversity Indices given by Simpson, 1949 and Shannon-Weiner, 1948).

A- Importance Value Index (IVI)

Importance value is a reasonable measure to assess the overall significance of a species since it takes into account several properties of the species in the vegetation. The density measurements reflect as to how many individuals were present, the dominance measurements denote which species is largest in terms of its presence and the frequency measurements indicate how widely species is distributed among the same plots. One advantage of using IV is that it dampens the effects of single large individuals, or infrequent species which, when present, are very abundant.Importance value index (IVI) will be calculated as per Curtis and McIntosh (1950). It is the sum of Relative Density (RD), Relative Frequency (RF), and Relative Dominance (RM).In this case, the minimum possible IV is

0, and the maximum possible is 300.

IVI = (RD + RF + RM)

B- Index of Dominance-Defining and Measuring Ecological Diversity

The abundance estimates may be used to estimate diversity indices and to assess hypotheses regarding the diversity of the whole communities. A very important aspect of this inferential procedure is the ordering of ecological communities with respect to diversity. The simplest method for measuring diversity is to merely count the number of species present, usually referred to as species richness. However, more precise measurement may be obtained by taking into account how the individuals are apportioned into species. Ecological diversity of weed vegetation occurred in study area was assessed statistically by using Shannon–Wiener Diversity Index (Shannon, 1948).

The number of species and number of individuals in a community is measure of species diversity which depends on stability of the habitat. Shannon and Wiener independently derived the function which has become known as Shannon index of diversity. This indeed assumes that individuals are randomly sampled from an independently large population. The index also assumes that all the species are represented in the sample.Simpson's Diversity Index is a measure of species diversity, often used to quantify the biodiversity of a habitat. It takes into account the richness (number of species present), as well as the evenness (relative abundance) of each species. The value of D ranges between 0 and 1; 1 represents infinite diversity and 0 means no diversity.Vegetation of the study area was assessed by determining:

Simpson Diversity Index denoted by

$$D = 1 - \left(\frac{\Sigma n(n-1)}{N(N-1)} \right)$$

Where,

Σ = summation; n = the total number of organisms of a particular weed species; and

N = the total number of organisms of all the weed species

Shannon-Weiner Diversity Indexde noted by

$$\bar{H} = -3.3219 \sum \left(\frac{ni}{N} \right) log \left(\frac{ni}{N} \right)$$

Where,

log implies to log base 10;

$\bar{H}$ = Shannon's index; ni = number of species;

N = total number of individuals (or any other parameter of importance); and ***(ni/N)*** is the proportion of all samples which belong to species I.

2-Analysis of Allelopathic Influence of Weeds over Wheat Crop

Allelopathy is a mechanism in which chemicals produced by weed plants may increase or decrease the associated plant growth. Several works have shown that allelopathy plays an important part in weed interaction (Tajuddin et.al. 2002) and weed crop interaction (Colton and Einhelling, 1980).Nature and influence of allelopathy have been assesed and examined in aqueous extract

of each botanical (weed) strains prepared by soaking crushed weed plant material in sterilized distilled water and kept at room temperature for 24 hrs. Weed plant material was collected at post flowering/mature stage only. The extract was filtered through Whatman filter paper No.1 and the filtrate has been used for treating crop seeds and plants in different experiments in order to find out the impact of weed's extract over crop physiology. In present course of investigation in place of liquid extract of weed material,the dried plant extract is used.

A-Percent Germination Behavior of Wheat Seeds

The germination of seeds under field conditions is often influenced by the presence of other plants. This interference arises from allelopathy (Rice, 1984). After 21 days, percentage or rate of germination of crop seeds has been observed.

B-Dry Biomass Production of Wheat Crops

Dry biomass of mature and healthy crop plants were selected and then treated similarly with weed extract powder and kept for 2 weeks incubation in laboratory condition and then its dry biomass was estimated in order to find out the influence of weed's allelopathic impact over growth yield of test crops.

3-Statistical Analysis

The data of various observations will be analyzed statistically by using one way Analysis of Variance (ANOVA).The mean data of three replicates of an experiment were analyzed using One Way ANOVA as described by Underwood (1997). Most of the time ANOVA is used to compare the equality of three or more means, however when the means from two samples are compared using ANOVA it is equivalent to using a t-test to compare the means of independent samples. The analogue of the unpaired t-test is one-way ANOVA while the two-way ANOVA, is the analogue of the paired t-test.

RESULTS AND DISCUSSION

1-Survey of Weeds Dominating in Wheat Cropl and Ecosystem

Diverse pasture communities may indirectly affect the amount of weed seeds that accumulate in soil by suppressing weed invasion into pastures. Since most annual weed species have long-lived seeds, the management strategies like maintaining high-resident plant-plant diversity may help reduce the accumulation of these seeds and prevent potential weed problems in the future (Tracy et.al. ,2004). The aim of the present study is to find out the common and dominant, occasional and rare weeds in wheat crop fields occurred in wheat cropland ecosystem of Lucknow region. During wheat cultivation cycle, seven weeds were observed and out of which four belongs to monocotyledons and three belongs to dicotyledons (Table 1). These weed speceies were characterized in terms of their taxonomic position, nomenclature and phytoconstituents present in them along with their topological terrain and its global status.

2-Assessment of Weed Community Inhabiting Wheat Cropland Ecosystem

Studies show that weed and canopy architecture especially plant height, location of

branches and height of maximum leaf area determine the impact of competition for light and thus have a major influence on crop yield (Cudney et.al., 1991). In community studies, quantitative estimation of community structure and composition are necessary. This needs precise sampling and accurate measurements. In order to get the dominance and ecological success of weeds occurring in wheat croplands observed during the wheat cultivation cycle in the experimental zone, different quantitative parameters have been assessed. Through quadrats these parameters viz., dispersion, numerical strength, and coverage were estimated and illustrated in Table 2. When dominance and ecological success of weeds were examined in terms of importance value index which evidiently demostrated that *C. album* secured the top position with having utmost IVI (73) followed by *P.minor* (67) and A. *fatua (60),* whereas *A. tenuifolius*(11) stands on the bottom in the list of the table followed by A. *arvensis* (18).

3-Ecological Diversity of Weeds in Wheat Cropland Ecosystem

Diversity in the strict sense is richness in speceis and is appropriately measured as the number of speceis in a sample of standard size. The Simpson index expresses dominance or relative concentration of the importance values into the first or first few species whereas the Shannon-Weiner index expresses the relative evenness or equitability of the importance values through the whole sequence (Whittaker 1972).

Shannon-Weiner diversity index (H) and maximum diversity (H_{max}) of weed community in studied wheat cropland was found to be 1.519 and 1.945 which clearly indicates that diversity lies in the normal range and the weed speceis are spread in an uneven and heterogeneous manner as the value of observed E (Evenness) comes in the range of less than one i.e., 0.7809 (Table 3).

Simpson index (D) was calculated from the observed data obtained by assessing weed's abundance in studied wheat cropland and it was found to lie in the range of 0.7301 (Table 4). The index D represents the probability that two individuals randomly selected from a sample will belong to different speceis. Simpson's index of diversity (1-D) and Simpson's reciprocal index (1/D) were also calculatedand it was found to be 0.2699 and 1.3696, respectively. The result once again strengthens the findings described above that weeds appeared and dispersed in thestudied cropland as an uneven and heterogeneous manner.

4-A Comparative Analysis of Impact of Three Selected Weeds over Percent Seed Germination and Dry Biomass Production in Wheat Crops

Walia et.al., (1998) concluded that wheat yield decreased exponentially when wild oat populations varied from 0 to 100 plants m^{-2} and the loss approached 50-60% at 100 plants of wild oats m^{-2}. High seeding rates of wheat also reduced the impacts of weed on crops in a number of previous studies (Lajos et.al. 2000; Hassan, 2006; Khan et.al. 2007). *Avena fatua* seedlings can exceed the crop wheat, barley, and

rye in its ability to emerge at greater depths in the soil. It has allelopathic phenolic compounds, which impact other plants, inhibiting germination and seedling growth (Sharma and Van den Born, 1978). Yield loss due to weed competition in the wheat fields has been reported to be about 21%. Approximately 79% of wheat (*Triticum aestivum* L.) and 72% of barley (*Hordeum vulgare* L.) hectares seeded in northwestern Minnesota are infected with wild oat (Dexter et.al. 1981). It was found that weed seedlings effectively competes for light by growing to greater heights than the wheat crop (Cudney et.al. 1991). The time of weed germination and emergence in the fields is influenced by environmental factors, such as light, soil temperature, soil moisture and soil atmosphere (Forcella et.al., 2000).

Out of seven wheat weeds , three weeds *(P. minor, A. fatua, and C. rotundus)* were screened for further investigation on the basis of their negative allelopathy over wheat crop's development and growth during wheat cultivation cycle. These three test weeds were examined in the light of percent germination of wheat seeds and dry biomass production in mature wheat crops and the data obtained were represented in figures 1, 2, and 3 for three above described weeds, respectively. When impact of weed was compared on two studied parameters, a pronounced inhibition was noticed in case of dry biomass production in comparison to inhibition in percent seed germination capcity of wheat crops and this negative influence was found to be more prounced in case of *P. minor* (Fig. 1), followed by *A. fatua* (Fig. 2), and *C. rotundus* (Fig. 3) consequently. At the level of treatment of 100g weed extract powder, the percent germination of wheat seeds (52%) and dry biomass production (73%) in mature crop plant was found to be severely inhibited in comparison to the control one (without weed extract treatment) which was taken as 100% in case of *P. minortreatments* while 40 and 58% inhibition in *A. fatua* was noticed in respective parameters studied. On the third position comes *C. rotundus* which inhibits 33 and 45% inhibition in test crop in comparison to control one.

That *Parthenium hysterophorous* along with Euphorbia *hirta* and *Ageratum conyzoides* severely inhibits the growth and development of rice crops studied in rice cropland ecosystem.
The group comparison test for two independent samples i.e., percent germination behavior in wheat seeds and dry biomass production in mature wheat crops were compared with control one and in presence of different levels of weeds (*P. minor, A. fatua,* and *C. rotundus*) incubated under experimental conditions were examined and then null hypothesis was tested to determine whether the variation among group sample means is greater than expected by chance or not.

The F-test is then performed by taking the ratio of among MS (Mean Square) and within MS.

$F_{critical}$=5.31 while $F_{observed}$=0.37 at alpha=0.05 and df=1, 8 for *P. minor*

$Fc_{ritical}$=5.31 while $F_{observed}$=0.65 at alpha=0.05 and df=1, 8 for *A. fatua*

$F_{critical}$=5.31 while $F_{observed}$=0.51 at alpha=0.05 and df=1, 8 for *C. rotundus*

Since $F_{observe}d < F_{critical}$, therefore can not reject null hypothesis H_0

It can be concluded that there is no significant inequality among the test samples assessed in light of percent seed germination and dry biomass production in wheat crops.

CONCLUSIONS

Weeds do enormous damage to the wheat crop. They directly deplete the soil nutrients and moisture and compete with crop plants for light and space which eventually reduce the crop yields. Indirectly, they alsocause damage to the crops harbouring pests and disease agents. Because their management involves costs therefore, reduction in the net returns make harvesting and threshing of crop costly and laborious along withdegrading the quality and value of produce. It has been estimated that due to weeds, the losses may range in between 20 to 70 percent in wheat crop depending upon their intensity.

In the present study, the commonly grown wheat weeds were studied in study area. Results indicated that all the weeds were competitive and caused substantial reduction in the vegetative growth and grain yield in wheat varieties. The present study concludes that both monocot and dicot weeds cause substantial reduction in growth and yield of wheat. These losses can be reduced by cultivating competitive wheat varieties.Further studies are suggested to screen more competitive wheat varieties against weed infestation to reduce the reliance on synthetic herbicides which significantly deteriorates the health of our planet as well as ourselves simultaneously.

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FEEDING AND MILKING MANAGEMENT PRACTICES FOLLOWED BY THE FARMERS IN RURAL AREAS OF TRANS-YAMUNA AREA OF ALLAHABAD

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ABSTRACT

The system of feeding and milking methods play an important role in the Dairy farming, thus the improved feeding and milking management is of utmost importance for increasing the production and quality of milk. The present study was conducted among 200 livestock owners comprising of twenty each, from ten villages of five development blocks in Trans-Yamuna rural area of Allahabad district of U.P. The study revealed that none of the farmers fed single fodder, a combination of two or more roughages were fed to their animals. *Ad lib* green feeding was not practiced. Majority (91%) of them offered concentrate to animals. Milk yield was the main criteria for feeding animals by 68.5 percent respondents. Majority (75.5%) of them practiced milking at the same place where animals were housed and 19.5 percent milked their animals at separate clean place. Regarding milking methods majority (60.5%) practiced faulty method i.e. wet hand milking, 54 percent adopted thumb in method and 73 percent farmers practiced stripping at the end of milking.

Key words: Feeding practices, milking method, fodder, colostrums

The tradition of cattle rearing and milk consumption, has been the part of our life since the ancient vedic times. Livestock is a critical natural resource with tremendous potential to provide self employment and income to millions of household in rural areas. Livestock sector still plays a crucial role in shaping the rural economy of India and is a major continuous income generating activity for the rural people (Rathore et. al., 2010). Uttar Pradesh, India's most populous state as well as world's most populous sub-national entity is the second largest state economy in India.

Uttar Pradesh, a part of the relatively more advanced agricultural regions, being the highest milk producing state contributes around 18 percent of the total milk production in the country. As per the 19th livestock census, U.P. has got the second highest cattle population (10.24%) and highest buffaloes population (28.17%) in the country, which accounts to around 16 percent of the total livestock and enjoys an enviable position in the country in its cattle wealth (Anonymous 2012). Good quality high roughage with low concentrate is essential and economical for feeding dairy animals.

MATERIALS AND METHODS

Five development blocks viz., Chaka, Jasra, Karchhana, Kaundhiara and Shankergarh of Trans-Yamuna area of Allahabad district of Uttar Pradesh were chosen for the present investigation. Two villages from each block and twenty household from each village comprising of five categories i.e. landless, marginal farmers (2.5 acre), small farmers (5.0 acre), medium farmers (upto 15.0 acre) and large farmers (>15.0 acre) were selected randomly and thus 200 respondents were selected for collection of needed information. Multistage stratified random sampling technique was adopted for selection of sample household. The information collected through personal interview technique through schedules and questionnaire purposely developed for the studies were analyzed statistically.

RESULTS AND DISCUSSION

Feeding Management Practices

The data regarding feeding management practices of dairy cattle and buffaloes in the study period revealed that none of the farmers fed single fodder, as they fed fodders in combination of two or more roughages to their animals. *Ad lib* green feeding was not practiced, but most of them fed green, legumes as well as non legumes along with other fodders. This could be ascribed to insufficient availability of single fodder therefore farmers of the area could not feed plenty of green fodder. Dhiman (1988) reported that 23.75 percent farmers fed green fodder throughout the year. Findings of Panwar (1992) and Rathore (2009) who reported 34.25 percent farmers cultivated and fed green fodder to their buffaloes round the year, are contrary to the findings of present study. Perusal of the data indicates that majority (91%) of respondents offered concentrate to animals, it was fed commonly with straw / bhusa by 80.5 percent farmers. Results are in agreement to reports of Dhiman (1988) and Panwar (1992).

Regarding the type of concentrates majority (33%) of the respondents offered mustard cake along with linseed cake, wheat flour / wheat bran. Findings are contrary to the reports of Panwar (1992), Rathore (2009) and Rathore et al. (2010). 10 percent respondents fed wheat flour/wheat bran and 11 percent, fed only mustard cake. The scale used for feeding animals was generally based on the milk yield, as this was followed by 68.5 percent farmers.

Practice of feeding roughage and concentrate to animals twice a day was most common within 72 and 70 percent of the farmers, respectively. Majority (43%) of the farmers practiced roughage feeding early in morning and late night, whereas 23 percent fed in morning, afternoon and late night. Green fodder was fed throughout the year by 23 percent farmers and rest fed it seasonally. The findings of present study are in consonance to findings of Dhiman (1988) and Panwar (1992). Regarding grazing practices, majority (83%) of them followed regular grazing which is similar to findings of Rangamma et al. (2013). 55 percent of respondents practiced grazing on post harvested fields and 15 percent on road sides, results are contrary to findings of earlier researchers may be ascribed to difference in the study area.

Regarding roughage feeding data revealed that majority (62.5%) of the farmers fed roughages *Ad lib.* 85 percent of the respondents practiced chaffing of roughages before feeding rest fed without chaffing. The findings are in line with findings of Panwar (1992), Rathore (2010) and Rangamma et al. (2013). The usual ratio of dry and green fodder of 1:1 was followed by 35 percent respondents, whereas 44 percent practiced 2:1 ratio of feeding. 1:2 dry green feeding was maximum in case of medium farmers (17.5%) followed by large farmers (13.89%) and marginal farmers (11.36%).

Regarding feeding of gur (jaggery) it was fed by 55 percent, whereas salt feeding was practiced by only 22.5 percent respondents. The highest percentage of large farmers fed gur (77.78) and salt (33.33) to their animals. Majority (52%) of respondents fed salt through feed followed by water (43%) and through chapatti (5%). The results are contrary to the findings to Panwar (1992) and in consonance to results of Rathore et al (2010).

Milking Management Practices

Data regarding milking management practices revealed that most of the respondents (75.5%) practiced milking at the same place where animals were housed, but 19.5 percent of them milked their animals at separate clean place, the findings are in consonance to Dhiman (1988) and contrary to the results of Kumar (2011). Regarding pre-milking cleaning, majority (78%) practiced washing of milking buckets along with teats, udder and milkers hand. Faulty methods i.e. wet hand milking was practiced by majority of farmers (60.5%) and 54 percent adopted thumb in method and only 33.5 percent practiced correct technique i.e. full hand milking thumb-out method. Simultaneously, 73 percent farmers practiced stripping at the end of milking. The findings are in agreement with the result of Dhiman (1988), Panwar (1992), Rathore et al. (2010) and contrary to Kumar et al. (2012).

Regarding handling of such animals those having let down problem, 46.5 percent of respondents adopted desirable (wait and try again) method, whereas 40 percent practiced providing some concentrates, none of them used oxytocin for the let down of milk. 35, 35 and 30 percent of the respondents practiced calf suckling before, after and both the time of milking respectively. However, the practice of calf suckling after milking is undesirable, because this is one of the contributing factors for udder injury and leads to develop tendency for residual milk. The findings are in agreement to the results of Dhiman (1988), Panwar (1992) and contrary to results of Rathore et al. (2010) and Kumar (2011).

Regarding the desired practice of colostrums feeding with in an hour after birth it was followed by 34 percent respondents. More than half of them (52%) allowed colostrums feeding before fall of the placenta (after four hours of calving). The findings are in agreement to the findings of Panwar (1992) and Rathore et al. (2010). Colostrum feeding ad lib was followed by 34 percent respondents the findings

are in close agreement with Rathore et al. (2010). Majority (80.5%) of them offered only one teat, rest two teats upto age of one month. Most of the respondents in the study area had knowledge about the importance of colostrums feeding and its usefulness in prevention against many diseases. The results are in consonance to the reports of Panwar (1992).

Regarding milk for young stock the data revealed that majority of the respondents (80.5%) offered milk of only one full teat, whereas 19.5 percent offered two teats upto one month age of the calf. Calves of 1 to 2 month age were offered one full teat by 38.5 percent, whereas 29.5 percent respondents offered one half teat to the calves of 2 to 3 months age. The findings are contrary to results of Panwar (1992) and Rathore et al. (2010).

CONCLUSION

The findings of the present study concluded that feeding and milking management practices in the study area were not very satisfactory. 44 percent farmers fed dry and green fodder in the ratio of 2:1. Dairy animals with high milk potential should be fed increasing quantity of concentrate to obtain their peak yields in the second month of lactation. As majority (54%) of the respondents practiced full hand-thumb in (Knuckling) method of milking this should be discarded as it injures the teat tissues.

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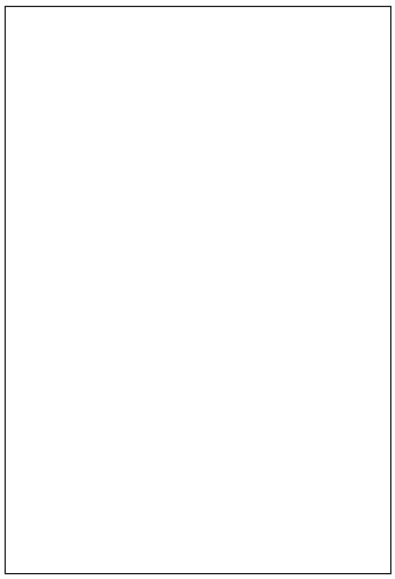

EFFECT OF PLANT DENSITIES AND PHOSPHOROUS LEVELS ON GROWTH AND YIELD OF COMMONBEAN (Phaseolous vulgaris L.) CV SAVANI LOCAL.

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ABSTRACT

According to result biometric characters like number of primary branch per plant (8.52), pod length (21.31Cm.) pod girth (12.35mm), number of pods per plant (37.02), number of seeds per pod (16.85), pod weight per plant (10.93g) and pod yield per plant (301.85g) were higher at lower density (37,037 plants/ha) along with 60 t P2O5/ha. The growth and yield characters like plant height (52.47 cm) TDM accumulation (3968.04 kg/ha), days to flowering (34.73days), days to first picking (44.28 days) and pod yield (152.87q/ha) were showed better expression in case of high density planting (74,074 plants/ha) along with 60kg P2O5/ha. The interaction effect of plant densities and phosphorous levels were also significant on plant height, total dry matter accumulation and days to flowering, pod length, pod weight per plant, yield per plant and pod yield/ha

Keywords: Plant density, phosphorous, common bean, yield.

Common bean plays a substantial role by serving as a vegetable crop mainly for the rural people in East, West, South and Central parts of Africa (Mortomore et.al., 1997). Common been used at all stages of its growth including as a vegetable (Offori and Stem, 1986) common bean Variety Savani local is a bush type. Pods are thick, light green long flat and highly fleshy. Yield potential of Savani local 28 t/ha. The optimum plant population is an important parameter for increasing the crop productive and provides the plants with the best environment to express its capacity fully under the given conditions. The optimum plant density with proper geometry and its planting varied with the agro-climatic conditions and growth habit of the plant.

MATERIALS AND METHODS

A field experiment was conducted at the Deptt. Horticulture K.A.P.G.College during kharif 2011. The experimental site had sandy loam with pH6.9, EC of 0.01 ds /m, 6.34 % organic carbon with 712, 32.5, 217.5 kg of N.P.K. per /ha respectively. The experiment was laid out in factorial randomized block design with three replications. There were twelve treatments combinations comprised of three plant densities (37, 037; 55,555 and 74.074 plants/ ha) designated as D1 ,D2 ,D3 and four levels of phosphorous(0,20,40,and 60 kg P2O5 / ha) designated as P0P1P2 & P3 the seeds were treated with captan @ 3g/kg seeds before sowing against wilt. The seeds were dibbled on 29-8-2010 at 60 x 45, 60 x 30 and 45 x 30 cm spacing. The nitrogen @ 20kg//ha, potassium

@10 kg/ha and phosphorous as per the treatments were applied during the crop period.A sample of five plants was taken randomly from central rows in each experimental plot at different intervals. The growth parameters like plant height, number of primary branches, dry matter accumulation days to flowering and days to first picking were recorded. Similarly the yield and its and attributes were recorded for estimating total dry matter accumulation, each sample was first air dried and later oven dried at 600C to constant weight. The sum of dry weights of all plant parts was taken as total dry matters accumulation per plant (g). The data were analyzed as per the method described by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The result revealed that the effect of plant densities and phosphorus levels on vegetative growth performance and yield were significant. The plant height increased with increasing plant density and decreased No. of primary branches per plant at all sampling occasions. Higher density produced tender and widely spread plants. Significant increase in plant height with high density (74,074 plants/ha) might be due to competition of solar energy coupled with shallow root system. Increased plant density limits the availability of space for plant and hence root configuration effecting the crop growth. These findings were in conformity with Khurana et.al.(1990) and Ahuja (1994). Increased plant height was noticed by Ahmed et.al. in 2010.

The TDM accumulation was higher at a plant density of 74.074 plant/ha. The result might be attributed to optimum use of natural resources, higher uptake of nutrients and more number of plants per unit area. Beneficial effect

Table.1 Effect of plant densities and phosphorous levels on plant height, number of primary branches/plant and days to flowering of commonbean CV Savani Local.

Plant height(cm) (At 60 DAS)						No. of primary branches (At45DAS)					Days to flowering(Days)				
Plant Densities	Phosphorus levels														
	P_0	P_1	P_2	P_3	Mean	P_0	P_1	P_2	P_3	Mean	P_0	P_1	P_2	P_3	Mean
D_1	55.60	55.930	56.67	58.80	56.75	18.07	18.53	18. 60	18.87	18.52	46.67	46.00	46.53	46.47	46.57
D_2	55.40	57.40	60.07	58.40	57.82	18.00	18.33	18.13	18.33	18.20	45.47	45.40	45.33	45.27	45.37
D_3	59.20	62.67	62.20	65.80	62.47	17.47	17.80	18.07	18.07	17.85	45.00	44.80	44.63	44.47	44.73
Mean	56.74	58.67	59.64	61.00		17.84	18.22	18.27	18.42		45.71	45.40	45.50	45.40	

Source	SEm±	CD(P=0.05)	SEm±	CD(P=0.05)	SEm±	CD(P=0.05)
Plant density(D)	0.12	0.34	0.11	0.31	0.06	0.18
Phosphorous Levels (P)	0.13	0.39	0.12	0.36	0.07	0.20
DxP	0.23	0.68	0.21	NS	0.12	NS

Table.2 Effect of plant densities and phosphorous levels on total dry matter accumulation of commonbean CV Savani Local.

Total dry matter accumulation						Total dry matter accumulation (60DAS)					Total dry matter accumulation (90DAS)				
Plant Densities	Phosphorous Levels														
	P_0	P_1	P_2	P_3	Mean	P_0	P_1	P_2	P_3	Mean	P_0	P_1	P_2	P_3	Mean
D_1	163.50	169.03	174.85	180.38	171.94	1945.66	1974.37	2001.67	2001.67	3788.40	3788.40	3798.77	3810.64	3867.50	3816.33
D_2	172.91	187.81	189.64	197.97	187.08	1965.17	1970.67	2014.28	2014.28	3874.41	3874.41	3885.98	3986.92	4096.85	3961.04
D_3	187.95	200.96	211.37	221.33	205.40	1951.19	1983.51	2094.43	2094.43	3722.81	3722.81	3865.74	4080.08	4203.51	3968.04
Mean	174.79	185.93	191.96	199.89		1954.00	1976.28	2036.79	2036.79	3795.21	3795.21	3850.17	3959.21	4055.95	

Source	SEm±	CD(P=0.05)	SEm±	CD(P=0.05)	SEm±	CD(P=0.05)
Plant density(D)	0.12	0.34	0.11	0.31	0.06	0.18
Phosphorous Levels (P)	0.13	0.39	0.12	0.36	0.07	0.20
DxP	0.23	0.68	0.21	NS	0.12	NS

Table 3. Effect of plant densities and phosphorous levels on no. of pods per plant, pod weight/plant and pod yield/ plant of commonbean CV Savani Local

Pod length(cm)						Pod girth(mm)					No. of pods per plant				
Plant Densities	Phosphorous Levels														
	P_0	P_1	P_2	P_3	Mean	P_0	P_1	P_2	P_3	Mean	P_0	P_1	P_2	P_3	Mean
D_1	8.47	11.80	11.83	13.13	11.31	31.87	32.00	32.27	33.27	32.35	45.13	46.47	47.47	48.33	46.85
D_2	8.53	9.40	10.67	10.53	9.78	31.33	33.13	32.53	32.00	32.25	45.13	46.07	47.00	47.67	46.47
D_3	6.80	7.13	12.33	12.27	9.63	30.93	31.27	32.00	32.07	31.57	45.13	45.33	46.07	46.93	45.87
Mean	7.63	9.44	11.61	11.98		31.38	32.13	32.27	32.44		45.13	45.96	46.84	47.64	

Source	SEm±	CD(P=0.05)	SEm±	CD(P=0.05)	SEm±	CD(P=0.05)
Plant density(D)	0.12	0.34	0.22	0.65	0.12	0.36
Phosphorous Levels (P)	0.13	0.39	0.26	0.26	0.14	0.42
DxP	0.23	0.68	0.44	NS	0.25	NS

Table 4. Effect of plant densities and phosphorus levels on no. of pod weight per plant and pod yield/ plant of common bean CV Savani Local.

No. of seeds per pod						Pod weight per plant(g)					Pod yield per plant(g)				
Plant Densities						Phosphorous Levels									
	P_0	P_1	P_2	P_3	Mean	P_0	P_1	P_2	P_3	Mean	P_0	P_1	P_2	P_3	Mean
D_1	5.13	6.47	7.47	8.33	6.85	109.60	110.50	111.70	111.93	110.93	589.23	601.82	605.16	611.17	601.85
D_2	5.13	6.07	7.00	7.67	6.47	109.57	110.20	111.40	112.00	110.79	552.78	555.82	557.47	560.76	556.71
D_3	5.13	5.33	6.07	6.93	5.87	109.60	109.67	109.83	110.20	109.83	496.93	503.76	508.20	516.68	506.39
Mean	5.13	5.96	6.84	7.64		109.59	110.12	110.98	111.38		546.31	553.80	556.94	562.87	

Source	SEm±	CD(P=0.05)	SEm±	CD(P=0.05)	SEm±	CD(P=0.05)
Plant density(D)	0.12	0.36	0.06	0.17	0.54	1.59
Phosphorous Levels (P)	0.13	0.42	0.07	0.20	0.63	1.84
DxP	0.23	NS	0.12	0.35	1.09	3.19

of optimum density on total dry matter accumulation has also been reported by Dwivedi et al. (1994) in Frenchmen. Though the number of primary branches per plant, pod length, pod girth, number of pods per plant were higher at lower density (37,037 plants/ha), it delayed the maturity. Higher photosynthesis and higher amount of dry matter assimilation due to higher number of leaves and higher availability of nutrients led to vegetative growth at a longer period as such the reproductive phase was delayed (Honma and Bert, 1977).

The higher pod yield per plant at low plant density (37,037 plants/ha) could be attributed to the significant increase in pod length, pod girth, number of pods per plant, number of seeds per pod and pod weight per plant. These values were significantly lower at higher density (74,074 plants 'ha) due to increased competition among the plants for the space, light and nutrients. Increasing population decreased the number of pods per plant. This reduction may be attributed to the interference among branches. The findings are in accord with the previous results reported by Weber et al. (1996) and Hamad (2004). The variations in number of pods per plant could be attributed to the variation in number of branches per plant. Hence lower plant densities resulted in maximum number of branches per plant and in turn were responsible for more number of fruiting points. Further, less competition for light, moisture and nutrients associated with wider spacing has an edge in producing more

reproductive parts compared to high density plants.

The plants growth, yield and its attributes were superior with the application of 60 kg P2O5/ ha. Increase in plant growth might be due to hastened meristematic activity, better root growth and better absorption of nutrients by increased application of P (Philip, 1993). The translocation of Photosynthates by the action of P also showed in improvement in various growth parameters (Verma and Saxena, 1995). Increased nodulation implies greater symbiotic fixation of atmospheric N which also helps in cell division and root extension which might have resulted in vigorous plant growth. Similar results were reported by Joseph and Varma (1994) in chickpea.

The phosphorus application @ 60 kg/ha showed a significant on days to flowering, days to 50 per cent flowering and days to first picking. Influence of P in hastening maturity is well documented. Phosphorus imparts quicker vegetative growth to the plant and entering into the reproductive phase early. The same trends of higher levels of P were also noted by Philip (1993) in cowpea and Bahadur and Singh (1990) in garden pea. The increase in yield attributes might be a direct consequence of growth characters. Adequate supply of P is important in the laying down the primordial for the reproductive parts of plants. It is also considered important in the formation of pods and seeds. Being a constituent of protoplasm, which may be responsible for increased length of pods, pod weight, number of seeds per pod and inturn pod yield? These results are in conformity with the finding of Sundara et al. (2004) in pea.

The interaction effect of application of 60 kg P2O5/ha and higher plant densities (74,074 plants/ha) produced higher pod yield along with rich protein content. The economic returns were more in case of high density as per the results obtained in the present experiment. It is also suggested that a plant density level D3 (74,074 plants/ha) and a phosphorus level of P3 (60 kg P2O5) was most profitable for the cultivation of vegetable cowpea cv. Savani Local under irrigated conditions in Allahabad area.

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CHEMOPREVENTIVE POTENTIAL OF TINOSPORA CORDIFOLIA AGAINST 7,12-DIMETHYLBENZ (A) ANTHRACENE INDUCED SKIN PAPILLOMAGENESIS IN SWISS ALBINO MICE

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ABSTRACT

According to result it was concluded that the topical administration of stem extract of this plant at 1000 mg/kg b.wt. during peri and post-initiational phases of papillomagenesis showed significant reduction in tumor incidence, tumor yield, tumor burden and cumulative number of papillomas as compared to carcinogen treated control. The average latent period significantly increased from 5.1±5.1 weeks in the control group to 7.1±2.79 weeks in the administrated group. Furthermore, a significant increase in reduced glutathione ($p<0.05$), level in liver and blood was observed in the T. cordifolia administered groups as compared to carcinogen treated control.

Key Words: Chemoprevention - DMBA- croton oil – Tinospora cordifolia- reduced glutathione papillomagenesis.

Cancer is a group of diseases with similar characteristics. Cancer can occur in all living cells in the body and different cancer types have different natural history. Epidemiological studies have indicated that the risk of cancer may be modified by changes in dietary habits (Prochaska, 1997). Humans ingest a large number of naturally occurring antimutagens and anticarcinogens in food, which may inhibit one or more stages of the carcinogenesis (Hocman, 1989). Several studies have indicated that compounds with antioxidant or anti-inflammatory properties as well as certain phytochemicals can inhibit tumor initiation, promotion and progression in experimental animal models (Perchellet and Perchellet, 1989; Chesson and Collins, 1997). One approach to cancer chemoprevention involves the administration of natural and synthetic nutrient or non-nutrient compounds in order to examine their potential role in the prevention of initiational and promotional stages of carcinogenesis (Boon et al., 1990). It has now been established that the plants, which naturally synthesize and accumulate some secondary metabolites, like alkaloids, glycosides, tannins, diterpenoid lactones, steroids etc, also contain minerals and vitamins, possess medicinal properties. Among the vast library of medicinal important plants Tinospora cordifolia of family Menispermaceae is a glabrous and succulent shrub, which is native to and widely distributed in India. Tinospora

cardifolia is immensely valuable in terms of pharmacology. A variety of active constituents have been isolated from different parts of Tinospora cordifolia. Mainly they are tinosporone, tinosporic acid, cordifolisides A to E, syringen, berberine,giloin, gilenin, crude giloininand, arabinogalactan polysaccharide etc, used in theruptic application(Sing et al.,2003). Because of presence of different active constituents this plant showes various activities such as Antiallergic, Anti-microbial, Antihyperglycaemic, Anti-oxidant, Anti-neoplastic activity etc.

MATERIALS AND METHODS

Animals:

The study was conducted on random bred 6-7 weeks old and 24- 28 gm body weight bearing, male Swiss albino mice (Mus musculus). Animals were maintained under controlled conditions of temperature and light (Light: dark, 10 hrs: 14 hrs.). They were provided standard mice feed (procured from Hindustan Levers Ltd., India) and water ad libitum. The study protocol is approved by the Departmental Animal Ethical Committee and confirms to the guidelines set by World Health Organization, Geneva, Switzerland and Indian NationalScience Academy (INSA), New Delhi (India).

Chemicals:

The chemicals, 7, 12-dimethylbenz (a) anthracene (DMBA) and croton oil were procured from Sigma Chemicals Co., St. Louis, USA. DMBA was dissolved at a concentration of 104 µg/100 µl in acetone. Croton oil was mixed in acetone to give a solution of 1% dilution.

Prepration Of Plant Extract:

Tinospora cordifolia Hydromethanolic stem powder poured in separating funnel with 50% Methanol at room temperature for 48hrs and then filtered. Again the 50% Methanol was added and allowed to stand for overnight and then filtered to concentrate it. The filtrate was kept at 55-60°C in Water Bath. The collected residue was finally transferred into the Hot Air Oven to dry it.

Procedure:

Experiment was performed as per the method of two stage protocol reported by Berenblum (1975) and standardized by us (Agrawal et al,. 2009) is known as a Skin carcinogenesis bio-assay. The animals were randomly divided into different groups and each group comprised of six animals. Hairs of mice were removed with the help of hair removing cream from the dorsal region with proper care in the area of 2cm2 in all the groups. 104µg DMBA was dissolved in 100µl acetone were given initially and after two weeks of initiation by DMBA, 1% Croton oil was given at 2 times a week up to 16 weeks. Skin tumors formation were recorded weekly and the papillomas greater than 1mm in diameter were included in to total number of papillomas/mouse, tumor incidence and tumor yield if they persisted two weeks or more.

Experimental Design:-

Route of Application: Topically

The treatment of Tinospora cordifolia Hydro-methanilc stem extract was given as

1000mg/kg body wt. per animal in 100µl.The animals were divided into 7 different groups, in which total no. of animals were 6-mice for each group. The groups were as follows:

Experimental Groups:-

Group I (Untreated control):- No treatment

Group II (Vehicle Control):-

These animals served as controls. These animals received topical application of acetone (1%) (100 µl / mouse) on the shaven dorsal skin 2 times in a week until the end of the experiment (i.e.16 weeks).

Group III (DMBA alone):-

100µl of single application was given to the animals at the dose of 104µg DMBA was dissolved in 100µl acetone to initiate the carcinogenesis.

Group IV (Croton oil alone):-

1% Croton oil was applied on the skin twice a week up to 16 weeks.

Group V (*Tinospora cordifolia* stem extract alone):-

100µl of extract alone at the dose of 1000mg/kg bwt was applied on the skin twice a week up to 16 weeks.

Group VI (DMBA+Croton oil):-

100µl of single application was given at the dose of 104µg DMBA was dissolved in 100µl acetone. Afterwards, 1% Croton oil was applied on skin 2 times a week up to 16 weeks.

Group VII (DMBA+ *Tinospora cordifolia* stem extract + Croton oil):-

104µg DMBA was dissolved in 100µl acetone and single application was given afterwards the 100µl dose of T. cordifolia stem extract at the dose of 1000mg/kg bwt was given one hour prior to each application of 1% Croton oil twice a week up to 16 weeks.

Biochemical Study:

Biochemical alterations were studied in all the groups at the time of termination of the experiment (i.e., at 16th week). This method was performed as per the method was reported by Owens et al., in (1995). The GSH content in blood was spectrophotometrically using Ellman's reagent with 5-5, dithiobis-2-nitrobenzoic acid (DTNB) as a coloring reagent.

Statistical Analysis:-

The differences of the tumors among different groups were considered to be significant at 5% significance level ($p<0.05$) when evaluated by Student's t test.

RESULTS AND DISCUSSION

The results of the present investigation have been summarized in Tables 1 and 2. Single topical application of DMBA followed by croton oil, produced skin papillomas, which started appearing from the sixth week onward. The tumor incidence in the DMBA + croton oil treated mice carcinogen control) reached 100% by the end of the experiment (16 weeks). When Tinospora cordifolia hydro-methanolic stem extract was applied topically at the dose of 1000mg/kg body wt twice a week for 16 weeks

to the animals (Group VII) Followed by single application of DMBA and twice a week application of croton oil, showed 60% percentage inhibition of tumor multiplicity and a significant decrease in the cumulative number of Papillomas, incidence, burden and yield of tumor appearance as compared to the DMBA + croton oil group. In this treatment group, the incidence of tumors was recorded as 66.6%. The cumulative number of Papillomas, burden, yield was significantly decreased and recorded as 16, 4.0 and 2.67 respectively. The 1st Papilloma appearance and average latent period was significantly increased and recorded as 55td day and 7.1±2.79 simultaneously. The number of Papillomas with tumor size <2mm and 2.4mm was also decreased and found to be 12 and 04. At the termination of experiment, no change was observed on the body weight of mice in this group. DMBA alone, Croton oil alone, Vehicle Control, No treatment, and Tinospora cordifolia extract alone, groups did not induced any tumor incidence. At the termination of experiment, there were no changes on the body weight of mice in these groups.

Studies with the Glutathione level on DMBA induced Skin Papillomagenesis in *Swiss albino* mice:

Estimation of GSH in Blood:-

The results of present investigation explore that, a significant reduction was noticed in the level of Glutathione reductase (GSH) of the carcinogen control (DMBA+CO) group i.e. 2.7±0.06µg/ml (Group II) while an enhanced level of GSH was observed i,e

Table No. 1 Studies with the effect of *Tinospora cordifolia* stem extract on DMBA induced skin *Papilloma model in Swiss* albino mice

Groups	Treatment Doses	Body weight (Mean ± SEM)		1st Appearance of Papilloma in days	Cumulative no. of Papilloma	Tumor Incidence (%)	Tumor Burden	Tumor Yield	Average Latent Period	Number of Papilloma with Tumor size (In mm)	
		Initial	Final							<2	2-4
I(n=6)	Vehicle alone (100µl acetone)	26.7±1.6	30.3±1.9	-	-	-	-	-	-	-	-
II(n=6)	DMBA alone (104µg/100µl acetone)	25.0±1.3	30.0±1.3	-	-	-	-	-	-	-	-
III(n=6)	Croton oil(100µl of 1% concentration)	25.6±2.2	28.8±2.8	-	-	-	-	-	-	-	-
IV(n=6)	No Treatment	26.8±1.2	30.9±1.1	-	-	-	-	-	-	-	-
V(n=6)	*T. cordifolia* stem extract alone (1000mg/kg b.wt.)	26.1±1.8	30.1±2.4	-	-	-	-	-	-	-	-
VI(n=6)	DMBA(104µg/100µl acetone)+Croton oil(100µl of 1% concentration)	26.0±1.4	25.0±1.3	39	40	6/6 (100%)	6.6	6.6	5.1±5.1	32	08
VII(n=6)	DMBA (104µg in 100µl acetone) + Croton oil (100µl of 1%) + *T. cordifplia* stem extract (1000mg/kg b.wt)	27.35±0.39	28.9±0.5	55	16	4/6 (66.6%)	4.0	2.67	7.1±2.79*	12	04

*denotes statistical significance as compared to DMBA+ CO group at p<0.05 followed by Student "t" test.

Photograph (a) Showing papillomas of control group

(b) Showing reduced papillomas of treated group..

3.33±0.052µg/ml in the group which was received the treatment of *Tinospora cordifolia* stem extract up to 16 weeks.

Estimation of GSH in Liver tissue:-

A significant reduction was found in the level of Glutathione reductase (GSH) in liver homogenate of the carcinogen control (DMBA+CO) group (Group II) which was recorded as 42.30±1.3µmole/gm when compared with GSH levels of normal mice. Whereas, an increased level of GSH i.e. 45.2±1.20µmole/gm was observed in the group (Group III) which received the treatment of *Tinospora cordifolia* stem extract for 16 weeks. The Treatment group (Group III) expressed significant value when compared with the Carcinogen control group (Group II) in the student 't' test ($p<0.05$). The concentration of GSH in Liver tissue of Normal mice (Group I) was found to be 52.80±3.343µmole/gm. The results are summarized in Table No.2.

The present study demonstrates 100% tumor incidence in the carcinogen control group. Topical application of TPA (active constituent of croton oil) has been reported to increase production of free radicals (Huachen

Table No.2.: Showing the effect of *Tinospora cordifolia* Hydro-methanolic *stem* extract on the level of Glutathione (GSH) in Blood and Liver homogenate of Papilloma bearing *Swiss albino* mice

S. No.	Groups	Treatment Doses	Glutathione level	
			Blood (µg/ml)	Liver (µmoles/gm)
1.	I	Normal mice	4.58 ± 0.65	52.80 ± 3.34
2.	II	Carcinogen control (DMBA + CO)	2.7 ± 0.06	42.30 ± 1.3
3.	III	DMBA+ *T. cordifolia* stem extract (1000mg/kg) + CO	3.33 ± 0.05*	45.2 ± 1.20*

*denotes statistical significance as compared to Carcinogen control at p<0.05 followed by Student "t" test.

and Krystyna, 1991). This is perhaps due to the free radical oxidative stress that has been implicated in the pathogenesis of a wide variety of clinical disorders (Das, 2002). Glutathione is one of the antioxidant enzymes that act as the first line of defense against pro oxidant stress. One of the mechanisms by which T. cordifolia rendered protection against carcinogen can be an elevation in the glutathione level that could have been mediated through the modulation of cellular antioxidant level. The anticarcinogenic effect in skin papilloma model in Swiss albino mice of T. cordifolia stem extracts were observed. The phytochemical study indicated the presence of diterpenoid in T. cordifolia extract which have been shown to anticarcinogenic activity. Newly isolated compounds like (5R, 10R)-4R, 8R-dihydroxy-2S, 3R: 15, 16-diepoxycleroda-13 (16), 17, 12S: 18,1S-dilactone (ECD), a diterpenoid from Tinospora cordifolia has been reported for its chemopreventive potential in diethylnitrosamine (DEN) induced hepatocellular carcinoma (HCC) in rats (Dhanasekaran et al., 2009). Another active compounds 11-hydroxymustakone, N-methyl-2-pyrrolidone, N-formylannonain, cordifolioside A, magnoflorine, tinocordiside and syringin function by boosting the phagocytic activity of macrophages, production of reactive oxygen species (ROS) in human neutrophil cells,(More and Pai, 2012) enhancement in nitric oxide (NO) production by stimulation of splenocytes and macrophages indicative of anti-tumor effects (Upadhyaya et al., 2011).These reports support our finding. Since T.cordifolia is an important herbal drug used as a tonic in Aruveda a traditional medical system of India.

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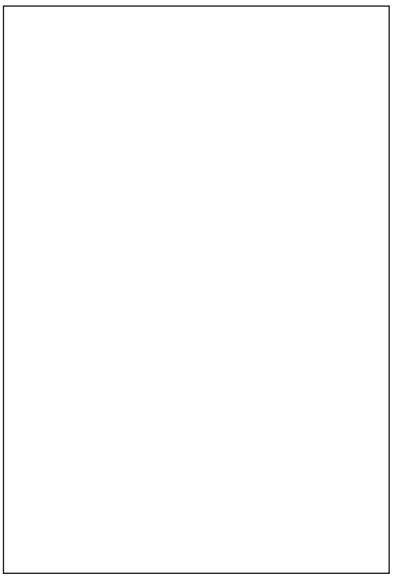

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EFFECT OF PHOSPHORUS AND BORON APPLICATION ON CHICKPEA *(Cicer arietinum L.)* UNDER THE RAINFED CONDITION

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ABSTRACT

According to result it was concluded that Chickpea responded to the application of phosphorus and boron upto combined dose of 60 kg ha^{-1} phosphorus (P_2O_5) and 2.00 ppm boron gave the highest growth and yield. This combination dose was adjudged as the best for chickpea was adequate for satisfactory yield. Dose of phosphorus @ 60 kg ha^{-1} and boron @ 2.0 ppm along with recommended dose of fertilizers also produced significantly higher straw yields over rest due to improvement in growth characters (length of root, number of leaves per plant, number of root nodules per plant and plant height). Similarly application of both nutrients also build up (the residual status of the same.)

Key words : Phosphorus, boron, chickpea.

Chickpea *(Cicer arietinum L.)* is a prime pulse crop of india largely rainfed agriculture extends over 97 m ha. Comprising of nearly 67 per cent of net cultivated area and has a share of 44 per cent food grain production and supports 40 per cent population. However, recently the rainfed area has decreased. Among the different crops being grown under rainfed areas pulses alone occupy 22 per cent of net sown area (Singh et.al., 1999). Alfisols and Kertisols are the two major soil types in rainfed areas. It occupies 7.1 m ha area with a production of 5.75 m tones, accounting for 30.9 per cent of total pulse area and 39.9 per cent pulse production.

Phosphorus and boron nutrition on chickpea need elaboration in the present content, phosphorus plays a vital role in the metabolism of pulses and is needed in higher amounts. It is beneficial to apply phosphorus to soils testing medium in olsen's P values (Bauder and Schaff, 1997). Translocation is governed by gated channels and these channels are formed by specific phosphoproteins. Flow of Ca, Mg and water is modulated by ADP/ATP. Thus P fertilization is essential in moisture deficient soils, due to above reason. Boron an pulse crops is worth mentioning because it promotes nodulation and biological nitrogen fixation.

There is a marked similarity in the dynamics of boron and phosphorus because both are anionic nutrients. Both are involved in esterification of negative alcohol groups in plants. Boron causes mobility of calcium and keeps Ca/K ratio under appropriate limit. It is involved in nitrogen absorption and protein synthesis, augment the formation of new meristematic tissue, proper pollination and fruit