ISSN - 0974 - 5033

Volume 4, Number 2, August 2009

JOURNAL OF NATURAL RESOURCE AND DEVELOPMENT

Society of Biological Sciences and Rural Development

10/96, Gola Bazar, New Jhunsi, Allahabad - 211 019 (U.P.)

Volume 4 Number 2 August 2009

JOURNAL OF NATURAL RESOURCE AND DEVELOPMENT

On line version at : www.sbsrdonline.in

Society of Biological Sciences and Rural Development

10/96, Gola Bazar, New Jhusi, Allahabad-211 019 (U.P.)

Vol. 4(2), August 2009

JOURNAL OF NATURAL RESOURCE AND DEVELOPMENT

CONTENTS

Journal of Natural Resource and Development 4(2):59-63, 2009

PAPER AND PULP MILL INDUCED ALTERATIONS IN GLYCOGEN AND LIPID DURING OVARIAN CYCLE OF *COLISA FASCIATUS* (BL. & Schn.), A FRESHWATER PERCH

Anuradha Shukla and J.P. Shukla

P.G. Deptt. of Zoology , S. Kisan P.G. College, Basti-272001(U.P.), India

ABSTRACT

Present investigation deals with the effect of pulp and paper mill effluent on the glycogen and lipid content during different phases of ovarian cycle of freshwater fish *Colisa fasciatus* after long term exposure at 5% and 10 % concentration of the effluent . No appreciable declining in the glycogen and lipid content was noticed in 5 % effluent concentration during any phase of ovarian cycle. However, 10 % effluent concentration brought significant alteration in selected biochemical parameters after long term exposure (30 days) in all the three principal phases (preparatory, spawning and post-spawning) of ovarian cycle of *Colisa fasciatus* which reflects the toxic index of pulp and paper mill effluent upon the reproductive physiology of the fishes.

***Keywords:** Pulp and paper mill effluent , Colisa fasciatus, Ovarian cycle, Total glycogen, Total lipid.*

Aquatic bodies are highly vulnerable to pollution since they act as immediate sinks for the consequences of human activity. Pulp and paper industry is one of the major industry in India and ranks high both in terms of water uses and pollution loads. During the chemical pulping and paper making process, hudge quantity of liquid wastes (effluent) is released from these mills (Dutta & Biosya,1998, 1999). The effluent also contains high BOD reflecting great degree of pollution. In India, the growth of paper industry has much raised during the recent past. There are about 220 paper mills in India of which more than 80% are small scale units having installed capacity of 30 tons/day (Ali and Rehman, 2008). These mills use agricultureal residuse like wheat straw, rice straw, grases etc. (Mahajan, 1985; Baruah and Das, 1996; Shastri, 1986; Subramanium, 1990). The pulp and paper industry generates more than 700 billions galane of deeply coloured and toxic effluents chiefly containing high molecular weight modified and chlorinated lignin. Approximately 300 chlorinated organic compounds in bleached pulp mill effluent have been indentified and about 200 of these are chlorinated rasin acid , phenols and dioxins (Huynth *et al*, 1985). At present very few pulp and paper industries provide treatement of the waste water, therefore, the water discharge contains large amount of sludge which creates handling and disposal problem. In Basti (U.P.), a pulp and paper mill has been established in the recent years which discharges its effluent in the nearby wastelands which during the rainy season may get their way into the adjacent aquatic bodies , in our case river Kuvano which may bring direct mortality and if not it may exert deleterious impact on the physiology of the fishes like growth and reproduction. Present study has, therefore, been undertaken to record the changes in the glycogen and lipid content during three principal phases of

ovarian cycle (Preparatory, Spawning and Post spawning) under two concentrations of pulp and paper mill effluent (5% and 10%) for 30 days of exposure.

MATERIALS AND METHODS

Pulp and paper mill effluent sample were collected from three sites. Sampling was done from the depth ranging from 20-25 cm. Precautions were taken to avoid any disturbance by loose segments. For analytic techniques the procedures outlined by APHA, 2005 was followed for the examination of industrial waste.

Fish *Colisa fasciatus* of an average length 6.9 cm. and weight 7.2 gm. were procured from local lake for experimental purpose . These were acclimatized for 12 days in laboratory dechlorinated tap water having the following physico -chemical features:

Temperature - 20.26 ± 1.6 degree cent.
pH- 7.4 ± 0.04
Hardness as CaCO3- 128.30 ± 4.12 mg/l
Electrical conductivity- 1296.62 µmho/cm.

During acclimatization, fishes were fed with dried shrimp powdered on alternate days at the rate of 5 % body weight. *Colisa fasciatus* though is an air breather, even then aeration facilities were given for 3-4 hours daily in control and experimental media. 5% and 10 % concentration of the effluent was selected to observe alterations in the selected biochemical parameters. The experiment run for 30 days.

Colisa fasciatus is an annual breeder perch. Its reproductively cycle through has been divided into six phases as reported by Pandey and Mishra (1981); however , only three principal phases namely preparatory, spawning and post spawning has been chosen to observe alterations under effluent stress when compared with control. In each phase 20 fishes were kept in control and experimental media. The total glycogen and lipid were estimated by adopting the standard methods outlined by Kemp and Kits (1954) and Pandey et al. .(1963) respectively. The values were tested for significance using students 't' test (Bailey, 1959).

RESULTS AND DISCUSSION

The physciochemical properties of effluent from Pulp and Paper mill contains mixture of pollutants and their magnitude has been shown in Table 1.

The total glycogen and lipid concentration in all the phases of ovarian cycle of *colisa fasciatus* exposed

Table 1.- Showing physicochemical parameters of effluent of Pulp and Paper mill.

Parameters	Magnitude
Colour	Dark Brown
Smell	Pungent
Temperature	29.2 °C
pH	8.0
TDS	1430 mg/l
COD	256 mg/l
BOD	80 mg/l
Chloride	24. 4 mg/l
Total nitrogen	1.42 mg/l
Nitrate	0. 44 mg/l
Sulphate	36.4 mg/l
Phosphorous	0.626 mg/l
Calcium	540325 mg/l
Magnesium	42.44 mg/l
Potassium	18.32 mg/l
Sodium	290 mg/l
Iron	2.12 mg/l
Zinc	3.56 mg/l
Lead	0. 16 mg/l
Copper	0.40 mg/l
Cadmium	0.06 mg/l
Magnesium	0.04 mg/l

to 5% effluent concentration for 30 days of exposure produced least significant alteration. However, significance decrease under 10% effluent concentration after 30 days of exposure, appreciable decline was observed in glycogen and lipid content during different phases of ovarian cycle (preparatory, spawning and post spawning as shown in Table 2)

The effluent from the pulp and paper mill are proved to be toxic and deeply colored (Abbasi, 1985). The color and toxicity of the effluent arise due to the presence of low and high molecular weight chlorinated organic compounds generated from liginin degradation product during processes like wood cooking, conventional bleaching and alkali interaction of the pulp. Although low molecular weight chloro lignines are partially removed from the effluent during an aerobic aerobic treatment process, the medium and high molecular weight liginins remain unaffected and pass with the effluent treatment plants into receiving aquatic bodies. The slow decomposition of these released toxic compounds like chlorinated phenols, dioxions and other compounds. Therefore , the effluents discharge from pulp and paper mills, even after anaerobic aerobic treatment exert various

Table 2 5% & 10% effluent impact on total glycogen and lipid content in (mg/gm) dry weight of ovary during its different phases (n=6)
** = P<0.01
*** = P<0.001

Ovarian cycle of phases	Biochemical Parameters	Control	5 %	% Change	10 %	% Change
Preparatory Phase	Glycogen (mg/gm.) dry weight of ovary	22.24± 0.36	20.86±0.52	6.20	18.08±0.38	18.70
	Lipid (mg/gm) Dry weight of ovary	72.46±1.38	70.86±1.84	2.20	62.12±1.62	14.26
Spawning Phase	Glycogen (mg/gm.) dry weight of ovary	28.22± 0.30	27.06± 0.38	4.11	21.26± 0.32	24.66
	Lipid (mg/gm) Dry weight of ovary	88.56± 1.72	86.66± 1.92	2.14	74.44± 1.68	15.94
Post Spawning Phase	Glycogen (mg/gm.) dry weight of ovary	12.22± 0.24	11.08± 0.28	9.32	9.88± 0.18	19.14
	Lipid (mg/gm) Dry weight of ovary	36.24± 1.28	34.62± 1.46	4.47	30.12± 1.02	16.88

negative effect on receiving aquatic ecosystem and their fauna in general in fishes in particular (Mishra *et al.*, 2007). In our observations, it becomes clear that there is an appreciable diminission in the glycogen and lipid content in all phases of ovarian cycle of *Colisa fasciatus* . From Table 2, it becomes clear that the level of glycogen and lipid in ovary during its control spawning phases was maximum in comparison to preparatory and post spawning which clearly indicates towards the possible to supply of carbohydrate and lipid content in the form of glucose and lipid derivatives for active maturation of female gametes (ova). The increasing order of decrease in glycogen content during preparatory and spawning phases of ovarian cycle of *Colisa fasciatus* may be due to its enhance utilization as an immediate source to meet energy demands for maturation of ova under effluent stress. It could also be on account of the prevalence of hypoxic or anoxic condition of the effluent which generally enhances glycogen utilization in one way or other (Dezwaan and Zandee 1973; Geetha *et al.*, 1991; Ozretic and Krajnovicozretic, 1993,Shukla *et al.*, 2005; 2012,) The decline in the lipid content during different phases of ovarian cycle of *Colisa fasciatus* might be partly due to its utilization in cell repair and tissue organization with the formation of lipoprotein which is salient constituent of cell membrane and cytoplasmic organales (Harper, 1983).

Our findings may be well correlated with the observation made by Ambrose *et al.* (1994); Vutukuru (2003,2005); Shukla and Shukla (2012) and confirms that long term exposure under pulp and paper mill effluent may interferes in the ovarian physiology of the fishes.

ACKNOWLEDGEMENT

One of us (JPS) is thankful to UGC, New Delhi for providing financial assistance vide letter no. F-38-103/2009 (SR) dated 24.12.2009 and to Dr. K. Gopal (ITRC, Lucknow, U.P.) for his technical assistance.

REFRENCES

Abbasi, A. 1985. Occurrence, toxicity and treatment of lignin in pulp and paper mill effluent state of the art. J. Environ., 65, 01-08.

Ambrose, T., Cyril, A.K.L. and Vincent, S.R.L. 1994. Bio chemical responses of *Cyprinus corpio* communis to toxicity of tannery effluent .J. Ecobiol. (3) , 213-216.

APHA. 2005. Standered methods for the examination of water and waste water . 21st edition, Washington D.C.

Ali, Z . and M. Rahman. 2008. Physico-chemical characterstics of pulp and paper mill effluent . Res. Environ. Life. Sci., 1(2), 59-60.

Bailey, N.T.J. 1959. Statistical methods in Biology . The english language. Book society, Great Britain. Chandravathi, M. and Reddy, S. LN. 1995. In vivo effects of lead acetate on dehydrogenase activities and metabolites in the fresh water fish, *Anabas scandens*. J. Ecotoxical. Environ Monit. 5(2), 107-111.

Baruah, B.K. and M. Das. 1996. Source aand characterization of a paper mill effluent . Environ. Ecology , 14: 686-689.

Dezwaan, A. and Zandee, DI. 1973. Body distribution and seasonal changes in glycogen content of the common sea mussel *Mytilus edulis* . Comp. Biochem. Physiol. 43, 53-55.3

Dutta, S.K. and C.L. Biossya. 1998. Effect of paper mill effluent on cholorophyll, leaf area and grain number in transplanted rice (Oryza sativa L. var. Maruri) J. Industrial Pollut Control. 14. 141-145.

Dutta, SK. and C.L. Boissya . 1999. Effect of paper mill effluent on growth yield and NPK content of transplanted rice (Orya sativa L. var. Masuri) J. Environ. Biol., 20: 29-32.

Geetha, S., Suryanarayan, H and Nair, N.B. 1991. On the nature of variations of biochemical constituents during the breeding cycle in *Heteropneustes fossilis* (Bl.). Proc. Nat . Acad. Sci India . GI (B) III, 311-315.

Harper, A.H. 1983. Review of Bio chemistry . 20th edition . Lange Medical Publication Co. California. 10-12

Huynth, V.B. , V.B., H.M/ Chang, T.W. Joyce and T.K. Krik. 1985. Dechlorination of chlororganics by a white rot fungus. Tappi., 68. 98-102.

Kemp, A.J.M. and Kits, V.H. 1994 . A calorimetric micro method for the determination of glycogen. J. Biochemical. 56, 640-648.

Mahajan, S.P. 1985. Pollution control in pulp and paper industries. In pollution control in process industries. Tata Mc Graw- Hill Publishing Company Limited, New Delhi. 235-254.

Mishra, R.R., Pandey. R.N., N.K. Singh and D.D. Tewari. 2007. Characterization of paper mill effluent and its possible treatment at Faizabad (U.P.). J. Nat Con. 19: 175-178.

Ozretic, B. and M. Krajnovicozretic . 1993. Plasma sorbitil dehydrogenase, glutamate dehydrogenase and alkaline phpsphate as potential indicators of liver intoxication in grey mullet (*Mugil auratus* Risso) . Bull. Environ. Contamin Toxicol,: 50: 586-592.

Pandey, S.V., Khan, A.P. and Subramanayam, T. A.v. 1963. Micro determination of lipid and serum fatty acids. Analyst Biochem. 6 (5), 120-125.

Pandey, K. and M. Mishra 1981. Cyclic changes in the testis and secondary sex characters of freshwater teleost , *Colisa fasciatus*. Arch. Biol (Bruxelles). 92, 433-499.

Sastri, C.A. 1986. Color removal from pulp and paper mill waste water . Indian . J. Environ Protect., 6. 501-113.

Subramanyum , PVR. 1990. Waste management in pulp and paper industry. J. Indian Assoc Environ Manage., 17: 79-94.

Shukla ., J.P. , Tripathi, S. Chandel, B.S. and Dwevedi , N.D. 2005. Detelerious effect of a metalloid (arsenic) on blood pyurate level in a tropical freshwater fish, Colisa *fasciatus*. Nat.J. Life Sci. (1 & 2); 125- 126.

Shukla, J.P.., Shukla Anuradha and Dubey R.K.. 2012a. Deleterious effect of hexavalent chromium on the blood pyruvate level in the fingerlings of *Channa puncatatus*. Int. J. Pharma & Biosci. 3(4), 789-794.

Shukla Anuradha & Shukla J.P. 2012(b). Quantitative alteration in the nucleic acids and protien during ovarian cycle of Colisa fasciatus (Bl.& Schn.) under distillery effluent stress Int. J. Pharma & Biosci. 3(3) 147-154.

Shukla Anuradha and Shukla , J.P. 2011. Distillery effluent induced alteration in the nuclic acid protein during testicular cycle of *Colisa fasciatus* (Bl. & Schn.), a tropical fresh water perch. Int J. Phar. Bio Sci; 3(1): B-532-537.

Vutukuru, S.S. 2003. Chromium induced alterations in some biochemical profiles in the Indian major carp, *Labeo rohita* (Ham.) Bull Environ. Contain Toxicol 70, 118-123.

Vatukuru, S.S. 2005. Acute effects of hexavalent chromium on survival, oxygen consumption hematological parameters and some biochemical profiles of the Indian carp, *Labeo rohita* . (Ham.) Int . J. Env. Pub. Health. 2(3): 456-462.

Journal of Natural Resource and Development 4(2):64-68, 2009

EFFECT OF Cd X Ca INTERACTION ON THE UPTAKE OF CADMIUM BY SPINACH

Dinesh Mani, Shiv Balak, Neeraj Pathak and Vishv Kumar Mourya
Sheila Dhar Institute of Soil Science, Department of Chemistry, University of Allahabad, Allahabad-211002, India

ABSTRACT

A pot experiment was arranged to study the effect of Cd x Ca interaction on the uptake of cadmium by spinach. The soil used was alluvial collected from experimental farm of Sheila Dhar Institute of Soil Science. (Texture: Silty clay loam, Clay: 36.4%, CEC: 20.7 Cmol (p^+) Kg^{-1}, Organic C: 0.51% and DTPA-Cd 0.36 ppm. Initial pH the soil was 7.6 which increased to 7.8 after irrigation. Plastic pots (each containing 5 kg of soil) were used. Spinach was grown as test crop.

Ca was applied as $CaCO_3$ to provide Ca at the rate of 0, 0.2, 0.5 and 1.0%. Cadmium was applied as $CdCl_2$ at the rate of 0, 5, 10 and 15 mg kg^{-1} soil with three replication of each treatment. The Yield of spinach decreased with the single application of cadmium, it improved when applied with Ca; The increase was observed up to 2.8% with 1% dose of calcium. The uptake of Cd was reduced with calcium application. An ameliorative effect of calcium was observed in Cd- contaminated soil.

Key words: *Cadmium, uptake, spinach, interaction,calcium*

The main goal of the subject is the understanding of behaviour of metals in the soil, their uptake by plants and the relationship with the environment. The anthropogenic use of heavy metals either through sewage-sludge or through fertilizers have received much attention due to enrichment of heavy metals in soil which impacts human health and social problems. (Gholamabbas *et al.*, 2010; Angelova, *et al.*, 2004; Yusuf *et. al.*, 2003). Among toxic heavy metals, cadmium is of great environment concern because of its higher bioavailability in soil-plant relationship and toxicity to human and livestock by readily getting in to food chain (Gupta and Gupta, 1998). The status of $CaCO_3$ and soil pH is also two crucial factors in term of availability of these heavy metals in sewage irrigated soil (Laetitia *et al.*, 2002)

Sewage-sludge is a product of waste water treatment processes which tends to concentrate potential contaminates such as pesticides, metals, pathogens, industrial solvents, dayes plasticizers and other organic chemical residues (Gibson *et al.*, 2005),

Increasing industrial production, utilization of fertilizers or natural sources may elevate content of heavy metals in the environment. This can be potentially dangerous for human health due to their bio-toxicity and high bioaccumulation throughout the food chain (Uraguchi, *et al.*, 2006).

MATERIALS AND METHODS

$CaCO_3$ was selected as an amendment for the study of interaction between Cd x Ca. For this purpose a pot experiment was arranged. The soil used was alluvial collected from Sheila Dhar Institute Experimental Farm (Texture: silty clay loam, clay: 36.4%, CEC:20.7 Cmol (p^+) kg^{-1}, Organic C: 0.51% DTPA- Cd 0.36 ppm). Initial pH of the soil was 7.6 which was increased to 7.8 after irrigation. Plastic pots of a 5 litre capacity (each containing 5 kg of soil) were used. Spinach was grown as test crop.

Ca was applied as $CaCO_3$ to provide Ca at the rate of 0, 0.2, 0.5 and 1.0% .Cd was applied as $CdCl_2$ at the rate of 0, 5, 10 and 15 mg kg^{-1} of soil with three replication of each treatment. Soil in each pot was mixed thoroughly to ensure intimate distribution of applied Cd and Ca.

All the pots received uniform basal application of 50 kg N, 50 kg P_2O_5 and 50 kg K_2O ha^{-1} as urea, single superphosphate and muriate of potash. Spinach (*Spinacea oleracea L.)* was selected as test crop. After 24 hrs of the treatments seed were sown. Soil moisture was maintained by irrigation the crops at intervals of 5-6 days. Spinach was harvested after 45 days

SOIL ANALYSIS

Silt and clay were separated by Pipette method and fine sand by decantation. Diethyltriaminepentaacetic acid (DTPA) solution {1.97g (0.05M) DTPA powder, 13.3ml (0.1M) Tri-ethanol amine and 1.47g (0.01M) $CaCl_2$ were dissolved in distilled water made up to 1 litre after adjusting the pH to 7.3} was prepared (Lindsay and Norvell 1978) to extract the available heavy metals in soil samples. Five gram of soil was shaken with 20ml of the above reagent for 2 hr. The clean filtrate was used for the estimation of Cd. Organic carbon was determined by chromic acid digestion method and CEC by using neutral ammonium acetate solution. For nitrogen a known weight of soil (1g) was taken in a 150 ml conical flask and treated with 10 ml of digestion mixture containing sulphuric acid and selenium dioxide. Ca was determined by EDTA method.

PLANT ANALYSIS

One gram of ground plant material was taken in a 100 ml beaker and 15 ml of tri-acid mixture (HNO_3, conc. H_2SO_4 and $HClO_4$ in 5:1:1 ratio) was added. The content was heated on hot plate at low heat (80°C) for 30 minutes and the volume was reduced to about 5 ml, until a transparent solution was obtained (Allen, *et al.*, 1986). After cooling, 20 ml distilled water was added to the beaker and the content was filtered through Whitman number 42 in to a 100 ml volumetric flask and the volume was made up with distilled water. The extract were analyzed directly with the help of Atomic Absorption spectrophotometer Perkin Elemar make modle ANALYST-100 at Central Environment Pollution Control Lab, Indian Farmer Fertilizer Cooperative (IFFCO), Phulpur (Li *et. al.*, 1995)

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 $SE = \sqrt{\frac{2V_E}{n}}$, where, V_E 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). The regression equation for estimating the y for various characteristics (x) was determined as: $y_c = \bar{y} + b_{yx}(x - \bar{x})$), where, $\bar{x}$ = mean x, $\bar{y}$ = mean y and b_{yx} = regression of y on x. The slope, intercepts, goodness of fit ($r^2 = b_{yx} \times b_{xy}$) and standard deviation (S_{yx}) were determined in accordance with (Motulsky and Christopoulos, 2003)

Table1: Effect of Cd x Ca interaction on dry biomass yield of spinach (g/pot)

[Ca] (%)	[Cd] (ppm)			
	0	5	10	15
	Dry biomass	Dry biomass	Dry biomass	Dry biomass
0	20.60	20.33	20.33	19.67
0.2	20.67	20.80	20.40	19.94
0.5	20.83	20.90	20.37	20.25
1.0	21.17	21.13	20.84	20.50

SE [0.05], CD [0.09]

RESULTS AND DISCUSSION

The data (table-1 Fig -1) indicated almost highly significant effects of Cd, Ca and Cd x Ca interaction on influencing the dry matter yield of spinach, which decreased as the doses of Cd increased up to 15 ppm. However, application on Ca up to 1.0% either singly or in combination increased the dry matter content of all the pots, which resulted in 2.8% extra dry matter yield over the control. Therefore, the response of Ca was observed ameliorative and encouraging in Cd contaminated pots. The adverse effect of Cd on the dry matter of spinach was observed higher in magnitude than that of Ca. The decrease in yield may be due to reduced photosynthetic rate and internal water deficit in shoot system due to poor root development. The effect of Cd was reduced in Ca-treated pots, which might be due to the ameliorative role of Ca in the physiology of plants(Cameron at al., 1997)

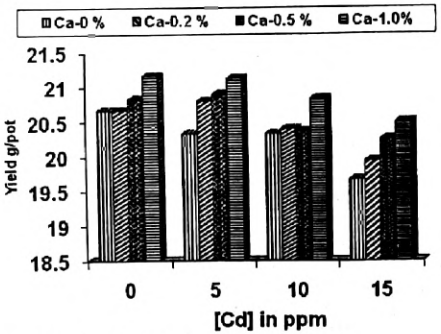


Fig. 1: Effect of Cd × Ca interaction on dry biomass Yield of Spinach

Table 2: Effect of applied Cd and Ca on Cd concentration in Spinach roots and shoots.

[Ca] (%)	[Cd] (ppm)							
	0		5		10		15	
	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root
0	0.21	0.18	0.24	1.55	1.39	2.95	2.25	3.48
0.2	0.15	0.10	0.85	0.95	1.19	1.33	1.06	1.49
0.5	0.10	0.15	0.26	0.29	0.32	0.32	0.45	0.35
1.0	0.5	0.10	0.09	0.09	0.19	0.26	0.09	0.22

Shoot: SE [0.01], CD [0. 0 2]
Root: SE [0.01], CD [0.02]

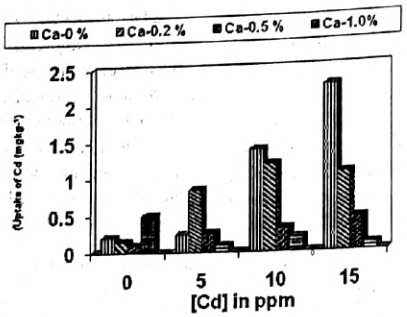


Fig. 2: Effect of Cd × Ca interaction on uptake of Cd in shoot of Spinach

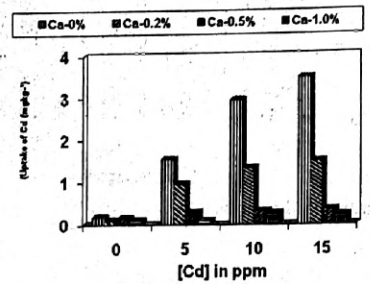


Fig. 3: Effect of Cd × Ca interaction on the uptake of Cd by root of Spinach

The data presented in Table 2, Fig 2 and 3 indicated that the highly significant effect of Cd, Ca and interaction of Cd x Ca on the uptake by root and shoots, both part of the plant .There is indication that relative Cd uptake is often greater from control to Cd added pots. The application of 15 mg kg^{-1} Cd registered the highest accumulation of Cd (3.48 mg kg^{-1} and 2.25 $mgkg^{-1}$ in root and shoot, respectively) in spinach. Application of Cd individually enhanced the Cd uptake by almost 19 fold in root and 11 fold in shoot of the plants. Application of 1.0% Ca diminished the Cd accumulation in almost all levels of applied Cd.

This might due to the chemisorptions of Cd in the soil due to lower ionization potential and electro negativity of the soil, which facilitated the metal cation to form strong complexes according to their ability to form covalent bond in the following order: Pb> Cr > Cd > Zn. (Xian and Shokohifard 1989, Rattan *et al.*, 2002.

CONCLUSIONS

The dry biomass yield of spinach was decreased with the single application of cadmium. But when it was applied with Ca (1%), the dry matter was increased lightly. The reduced uptake of Cd was observed in Ca treated plots. An ameliorative effect of Ca was observed in Cd-contaminated soil. The results of presented study showed that Ca can effectively immobilize Cd in the soil. Ca has potential to reduce Cd accumulation in both root and shoot of the spinach.

Among the heavy metals Cd is of greater concern due to its higher rate of plant uptake and accumulation in body parts. All the vegetables show accumulation of heavy metals in their edible parts and as these vegetables are supplied to local markets, there is a possibility of health hazard associated with consumption of these contaminated vegetables over a long period of time.

The application of Ca 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. In order to reduce risks, plants with lower accumulative nature should be growth for which further species and varietal screening should be done. A more detailed study is required to grow spinach or other vegetable crops in metals-contaminated areas and evaluate their growth and distribution of heavy metals in different edible parts of plants.

ACKNOWLEDGEMENT

Authors are grateful to Dr. Pradeep Ranjan, Sr.Manager (R&D), Indian Farmers Fertilizers Cooperative Ltd. (IFFCO), Phulpur, Allahabad for analyzing soil samples for heavy metals by AAS.

REFERENCES

Allen S.E.; Grimshaw, H.M. and Rowland, A.P., 1986. Methods in Plant Ecology. Blackwell Scientific Publication, Oxford, London, pp. 285-344.

Angelova, V.; Ivanov, A. and. Ivanova, K., 2004. Effect of chemical forms of lead, cadmium and zinc in polluted soils on their uptake by tobacco. *J. Plant Nutri.*, 27 (5), 757-773.

Cameron, K.C.; Di HG,; MacLaren, R.G., 1997. Is soil an appropriate dumping ground for our wastes? *Australian Journal of soil Res.* 35:995-1035

Gholamabbas, S.; Majid, Sayed, A.A.; Sayed, F.M.; Karim, C.A.; Brian, K.R. and Rainer, S., 2010. Transport of Cd Cu, Pb and Zn in a calcareous soil under wheat and sunflower cultivation-Acolumn study. *Geoderma,* 154, 311-320.

Gibson, R.; Wang, M. J.; Padgett, E. and Beck, A., 2005. Analysis of 4-nonylphenols, phthalates and polychloride biphenyls in soil and biosolids, *Chemosphere,* 6, 1336–44.

Gupta, U.C. and Gupta, S.C., 1998. Communication in soil Science and Plant Analysis, 29, 1491-1522.

Laetitia, P.B.; Nathalie, L.; Alain, V. and Cyrille, F., 2002. Heavy metal toxicity: Cd permeates through Ca channels and disturbs the plant water status. Plant. 32(4), 539-548.

Li, X.;Coles, B.J.; Ramsey, M.H. and Thornton, 1995. *Chemical Geology.* 124, 109-123.

Lindsay, W.L. and Norvell, W.A., 1978. Development of DTPA soil test zinc, iron manganese and copper. *Soil Sci. Soc. Am. J.* 42, 421-428.

Motulsky, H.J. and Christopoulos, A., 2003. GraphPad Software Inc, San Diego CA.

Ratten, R.K.; Datta, S.P.; Chandra, S. and Saharan, N., 2002. Heavy metals and environment quality. Fertlizer News (India). 47(II), 21-40.

Uraguchi, S.; Watanabe, I.; Yoshitomi, A.; Kiyono M. and Kuno, K., 2006, *J. Exp. Bot.,* 57, 2955-2965.doi:10.1093/jxb/erl056.

Xian, X. and Shokohifard, G., 1989. Effect of pH on chemical forms and plant availability of cadmium, Zinc and lead in polluted soils. Water Air Soil Poll. 45:265-273

Yusuf, A. A.; Arowolo T. A. and Bamgbose, O., 2003. Cadium, copper and nickel levels in vegetables from industrial and residential areas of Lagos city, Nigeria. *Food Chemistry and Toxicology,* 41, 375-378.

Journal of Natural Resource and Development 4(2):69-70, 2009

EFFICACY OF DIFFERENT LEVELS OF SPENT COMPOST (WHEAT STRAW) OF OYSTER MUSHROOM (PLEUROTUS SAJOR CAJU) ON THE GROWTH PARAMETER OF WHEAT PLANT (TRITICUM AESTIVUM)

Hemlata Pant and Gopal Pandey

Society of Biological Sciences and Rural Development, 10/96, Gola Bazar, New Jhusi, Allahabad-211019 (U.P), India.

ABSTRACT

Different levels of spent compost of oyster mushroom viz. 50gram, 100gram, 150 gram and 200 gram per pot were taken for experimental purpose. The spent compost amended with sterilized soil. Data indicated that all the treatments showed higher plant growth parameters over control. Higher shoot length (60.16 c.m.) was recorded in soil amended with 50 gram spent compost of oyster mushroom followed by (58.90c.m.) 100 gram, (58.30 c.m.) 150 gram and (58.10 c.m.) 200 gram respectively. Maximum fresh weight of ears (10.30 gram) was also found in soil amended with 50 gram spent compost of oyster mushroom followed by (9.60 gram) 100 gram, (9.30 gram) 150 gram and (9.00 gram) 200 gram respectively.

Key words: Pleurotus sajor caju, levels, spent compost.

Wheat is an important winter cereal and occupies 52.8 percent of the total Rabi food grains. India with 26.0 million hectares is the second largest wheat growing country and contributes over 69.0 million tones of the total production. Besides protein, it contains characteristics substance 'gluten' which is essential to bakers. Wheat also contains carbohydrates, minerals and vitamins. (F.A.O.1997). Normally the yield of crop effected by different cultural, environmental, physical, mechanical, biological and chemical factors. The yield also influenced by the application of more quantity of inorganic and organic fertilizers. By these methods of yield increased up to limited extent and after that it becomes constant. To increase the yield further a new line of study is used viz. efficacy of different levels of spent compost (wheat straw) of oyster mushroom on the growth parameters of wheat plants.

MATERIALS AND METHODS

Pot experiment was conducted at National Academy of Biological Sciences and Rural Development (A Research wing of Society of Biological Sciences and Rural Development) New Jhusi, Allahabad. Twenty earthen pots of 30c.m. diameter were taken for experimental purpose. The pots were sterilized in 4% formalin and filled with sterilized soil. Spent compost of oyster mushroom was applied in soil before 15 days sowing. P.B.W.-502 variety of wheat was sown in each pot. The seed rate was two seed per pot for the crop. After emergence seeding were thinned to one seedling per pot. Pots were irrigated normally. There were five levels of treatments replicated four times. At senescence's stage of plant crop observation were recorded on the following parameters viz. shoot length and fresh weight of ears. The treatments are as follows :

T1= Soil + Spent compost of oyster Mushroom (2 Kg+50 gram/Pot)
T2= Soil + Spent compost of oyster Mushroom (2kg+100gram/pot)
T3= Soil+ Spent Compost of oyster Mushroom (2kg+150gram/pot)
T4= Soil + Spent compost of oyster mushroom (2 kg +200 gram/pot)
T0= Control (Soil) (2kg /pot)

RESULTS AND DISCUSSION

Observation recorded has been presented in Table No 1. Higher shoot length (60.16 c.m.) was recorded in soil amended with 50 gram spent compost followed by (58.90 c.m.) 100 grams, (58.30 c.m.) 150 gram and (58.10 c.m.) 200 gram respectively. Maximum fresh weight of ears 10.30 gram was also found in soil amended with 50 gram spent compost followed by (9.60 c.m.) 100 gram, (9.30 gram) 150 gram and (9.00 gram) 200 gram respectively. 50 gram spent compost of wheat straw was give better result because it may be due to quick metabolism of spent compost, release of nutrient which accelerate root development and overall plant growth of wheat plants. Metabolites of microbes which because active during decomposing of spent matter and toxic to harmful fungi and bacteria. Application of 100 gram, 150 gram and 200gram of spent compost were not increase growth parameters and fresh weight of ears because it may be due to the increasing level of spent compost, during decomposition maximum number of microbes were developed inside the soil and these increased microbes absorbs themselves maximum nutrient. So these plants do not take sufficient amount of nutrients. So the growth parameters and size of ears were affected. Therefore 50 gram spent matter is recommended for the development of plant growth parameter. Some other workers have also reported to similar observation during their studies. (Pant and Pandey 2011,2012), Pathak *et.al.*, (1996), Mushroom Utpandan Prashishan (2006).

Table 1. Effect of different levels of spent compost of oyster mushroom (*P. sajor coju*) on the shoot length and fresh weight of ears of wheat plants.

Sr. No.	Treatement	Shoot length (c.m)	Fresh weight of ears. (g)
1	T_1	60.16	10.30
2	T_2	58.90	9.60
3	T_3	58.30	9.30
4	T_4	58.10	9.00
5	T_0	57.93	8.57
6	c.d. @ 5%	2.289	0.931
7	Result	NS	S

ACKNOWLEDGEMENT

First author is very thankful to D.S.T., Govt. of India, New Delhi for providing financial assistance (as scientist WOS-B programme, project No. SSD/SS/027/2008).

REFERENCES

FAO, 1997. Production year book vol. 51.Mushroom utpadan prashishan, 2006. Published from Nideshalay Prasar Shiksha (G.P. Pant University of Technology), Uttaranchal, 1-25.

Pathak, V.N., Yadav Nagendra and Gaur, Maneesha, 1996. Mushroom Production and processing Technology (Book), Agrobios (India), 1-173.

Pant, Hemlata and Pandey, G., 2011. Effect of different concentrations of spent matter (Wheat Straw) of oyster mushroom (*P.Sajor caju*) on the growth fo Tomato plant. *J.Env. Bio-Sci.* 25 (2): 349-350.

Pant, Hemlata and Pandey, G., 2012. Effect of different levels of residual compost (wheat straw) of oystor mushroom on the growth of maize (babycorn) plant. Vij. Pari. Anu. Patrika 55 (2) : 11-14.

Journal of Natural Resource and Development 4(2):71-74, 2009

COWPEA SEED SCREENING FOR ASSOCIATED FUNGAL PATHOGENS

Razia K. Zaidi and Neha Pathak*

Botany Section, Women's College, A.M.U. Aligarh.

**Section of Plant pathology and Nematology, Department of Botany, A.M.U. Aligarh. 202 002. U. P.*

ABSTRACT

Fungi associated with the seeds often take a heavy toll of the crops. If the crops are raised from these pathogen laden seeds. Seeds health testing and screening of seeds revealed the presence of some important fungi such as *Alternaria, Curvularia, Drechslera and Fusarium.* These fungal members cause severe damage decay to the seed lots and produce mycotoxin which further make the situation grim. Thus seed health testing and screening for the direction of seed mycoflora should be an essential part of our agricultural practices so that the losses due to post-harvest inoculums can be minimized.

Key words: Screening, Fungal, Pathogen, Cowpea.

Cowpea, *Vigna anguiculata* is a protein rich crop.Seeds are known to carry pathogens which adversely affect the cowpea yields.Seed borne inoculam can severely endanger to seedlings and plant vigour and cause extensive damage to the plant at different stages of life cycle . Seed health testing is an important aspect in reducing these pathogens. In the present paper an attempt has been made to study the different aspects of seed health testing procedures including the seed screening processes. International rules for seed testing association (ISTA) were followed throughout these studies. . Seeds play a vital role in the transmission of disease causing agents. These seed borne pathogens may cause seed abortion, seed rot, seed necroses, and reduction in germination as well as seedling damage (Fakhrunisa,et.al 2006,Riaz,et al,2002).

MATERIALS AND METHODS

International rules for seed testing (Annonymous, 1966) were followed in the present investigations. For the study of seed mycoflora , seeds were collected from Kwarsi agricultural farm of Aligarh district of U.P. state.

INSPECTION OF THE DRY SEEDS: Seed samples were examined with naked eye and under 40X-50X magnification of stereo binocular for contaminants and other apparent disorders like presence of pycnidia, conidia, discoloration and deformation .

EXAMINATION AFTER SOAKING THE SEEDS: According to ISTA rules (Annonymous,1966), the seeds are submerged in water to make fruiting bodies more easily visible and to provide conditions for liberation of spores. In the present investigations, 400 seeds of cowpea were submerged in sterilized water in Petridishes and left for 12 hrs to swell before examination .

EXAMINATION OF MATERIALS REMOVED FROM SEEDS AFTER WASHING: Seed washing technique was employed to study the seed health. Seeds were centrifuged for 10 mints. The clear supernatant fluid of the washings

INSPECTION OF DRY SEEDS OF COWPEA (OBSERVATIONS BASED ON 400 SEEDS)

S. No.	OBSERVATIONS	REMARKS
1.	Colour Of Pericarp	Brown & White
2.	Discoloration & Blemishes	3% seeds
3.	Mycelia bits & Conidia	8.75% black & white patches
4.	Pycnidia	-
5.	Sclerotia	-
6.	Cleistothesia	-
7.	Other fructifications	-
8.	Inert Matter (stem parts, leaf bits, floral parts & soil particles)	2.5%, soil & humus adhering to seeds & pieces of other matter
9.	Damaged seeds	8%
10.	Deformed seeds	14.75% dwarf & wrinkled

was then discarded and the residue was collected in small petri-dish, drops of residue were examined under compound microscope.

RESULTS AND DISCUSSION

Different techniques were employed to study the mycoflora associated with seeds of cowpea which can destroy the quality of the seeds and can cause a loss to its dietary and nutritional value.

- **Inspection of dry seed** samples with naked eye and with stereo binocular (40x-50x magnification) revealed the presence of contaminated seeds with inert matter, infected materials discolouration and damaged seeds.
- 3.0% seeds showed discolouration.
- Mycelial bits and conidia were detected from 8.75% seeds.
- 2.5% inert matter was detected.
- 8.0 % damaged seeds were recorded.
- 14.75% deformed seeds (dwarf and wrinkled) were observed.

EXAMINATION AFTER SOAKING THE SEEDS: Seeds were then examined after soaking in the manner described as above under stereobinocular and later placed in drops of water and examined microscopically for the identification of conidia and mycelia bits. Study reveled the presence of floating mycelia bits and conidia of Aspergillus, Alternaria, Drechslera, Curvularia and Fusarium.

EXAMINATION OF MATERIAL REMOVED FROM SEEDS BY WASHING: Washingof seeds were examined, mycelial bits and conidia of fungi like *Alternaria, Fusarium and Drechlera species were found.*.

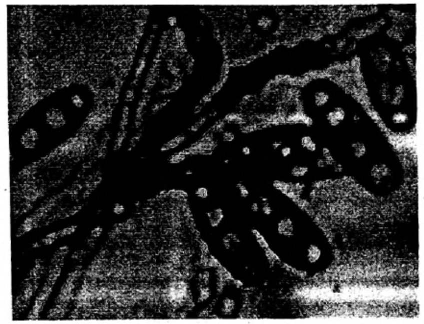
Following the ISTA rules, seed washing technique was employed to study the seed health. Four hundred seeds were taken in 100 ml flask to which 25 ml sterilised distilled water was added. The seeds were shaken vigorously

on a shaker for 15-20 minutes and washings were centrifuged for 10 minutes.The clear supernatant fluid of the washing was then discarded and the residue was collected in a small petridish. Twenty drops of the rsidue were examined on clear slides under compound microscope. Conidia and mycelium of *Alternaria alternate*. *Drechslera australiensis* and *Fusarium moniliforme* were identified. Conidia of *A. alternate* and *F. moniliforme* were quite abundant.

- Fungi which were recorded from the seed samples can cause damage to the quality of

Spores of Curvularia

Spores of Alternaria



Spores of Drechslera

seeds, which secrete mycotoxins and which can interfere with the good qualities of the seed and devalue the seeds(Shfique et.al,2007,Kunwar,1989,Sinha and Khare,1977).Seed borne pathogens are responsible for causing variations in plant morphology and also reducing the yield from 15-90% if infected seeds are planted in the field (Wiese,1984) Each year about 20% of the grain that otherwise would be available for food and fodder is lost due to diseases. These seed associated fungi either directly cause the decay and deterioration of seeds or they may discolour sseds, kill ovule,weaken or kill the embryos,cause shrivelling of seeds

and may produce mycotoxins (Agrios,2000).Thus it is conclude that seed screening for the detection of seed borne fungi should be an essential part of our agriculture because seed health play an important role for successful cultivation and obtaining a high yield.

REFERENCES

Agrios,GN,(2000),Significance of plant diseases.Plant Pathplogy.Academic Press,London.pp.24-37.

Annonymous.1966,International seed testing association. International rules for seed testing. Proc.Int.Seed Test Assoc. 31:752.

Fakhrunisa, M.H., Hashmi and Ghaffar,A. (2006). Seed-borne mycoflora of wheat,sorghumand barley,Pak.J.Bot.38:185-192.

Kunwar,I.K.(1989).Mycoflora associated with stored wheat and its milling fraction in India.Plant Sci.,99:437-443.

Riaz,A.,Khan, A.S. andHaque,I.U.(2002) frequency of seed-borne mycoflora of groundnut and their impact on sees germination. Pak.J.Phytopath. 4 :36-39.

Shafique,S.Javaid,A. Bajwa, R.,Shafique.S. (2007) Effect of aques leaf extract of allelopathic trees on germination and seed borne mycoflors of wheat.Pak. J.Bot.39:2619-2624.

Sinha,O.K. and Kare,M.N.(1977)Chamical control of Macrophomina phaseolina and Fusarium equsitie associated with cowpea seeds. Indian Phytopath.,30:337.

Wiese, M.V. (1984)Compendium of wheat diseases 3rd Ed.The Am.Phytopath.Soc.pp:106.

Journal of Natural Resource and Development 4(2):75-77, 2009

HEAVY METAL LEVELS IN VEGETABLES GROWN IN SEWAGE IRRIGATED SOILS OF ALLAHABAD, INDIA.

Dinesh Mani, Vishv Kumar Mourya, Shiv Balak and Neeraj Pathak
Sheila Dhar Institute of soil science, Dept. of Chemistry, University of Allahabad, Allahabad

ABSTRACT

This study was conducted to analyze the heavy metal in a selected sewage irrigated area in Allahabad, India. Recently matured leafy vegetables (Spinach) from four (4) different sewage irrigated area were sampled, digested using 98% nitric acid (HNO_3) and analyzed with the aid of Atomic Absorption Spectrophotometer (AAS) to determine heavy metals. The mean concentration for each heavy metal in the samples gotten from each sewage irrigated were calculated and the comparison of these data was done among six sewage irrigated area, and compared with the permissible levels set by the FAO and WHO. Results showed that the levels of Cadmium and Zinc for the ranged from 0.028 to 0.094 and from 0.34 to 0.84mg/kg dry weight respectively. Lead was not detected in all the samples. When compared with standards, heavy metals levels were found to be within safe limit.

***Key words:** Heavy metals, Vegetables, Sewage-irrigated Soil,*

`International and national regulation on food quality have lowered the maximum permissible levels to toxic metals in the food items due to increased awareness to the these metals pose to food chain has been reported in many countries.Heavy metals contamination in vegetables cannot be underestimated as these food stuffs are important components of human diet. Heavy metal contamination of the food itmes is one of the most important aspects of food quality assurance (Marshall, 2004).

The problem associated with the disposal of sewage water and municipal wastes are crucial aspects of water pollution, which could be considered in the context of wider current environmental issues (James, 1971). Application of waste water for irrigation purposes has increased over the past years. This waste water contains high amounts of trace elements and heavy metals. Waste water are contaminated with trace elements like lead (Pb), cadmium (Cd), nickel (Ni), mercury (Hg), uranium (U), cooper (Cu), arsenic (Ar), chromium (Cr), boron (B), manganese (Mn), etc. Many of trace are non- essential and are toxic to plant, animals and human beings. Waste water is suitable for irrigation if the content of toxic element reduced considerably.(Kanwar and Sandha, 2000)

MATERIALS AND METHODS

Collection of Sample

Three sample of vegetable (Spinach) were purchased from four sewage irrigated area in Allahabad in each sewage irrigated, three sample were identified and samples collected from each at different times. A total of 15 samples were collected from the different markets which include: Phaphamou Sewage farm, Naini sewage farm, Rasulabad sewage and Buxi Bandh sewage farm.

Pretreatment

After collection, the samples were brought to laboratory and processed further for analysis. Edible portions of the samples were used for analysis while bruised or rotten sample were removed.

Washing of Sample:

The edible portions of the collected vegetable samples were properly separated and washed to remove dust particles. The samples were then chopped into small pieces using knife. The vegetable were air-dried and then dried in an oven at 80°C.

Grinding of samples:

Dried sample of vegetable were ground into a fine powder (80 mesh) and stored in polyethylene bags until used for acid digestion.

Acid Digestion:

Heavy metals in vegetable sample were extracted following acid digestion procedure as follows: 1.0 g of the dry weight of each the sample collected at those sewage area was weighed into digestion tube. Then plased in a water bath and allowed to boil for adout 72 hours. After which digestion was completed, the resulting pale yellow solution was made up to 100 ml with di-ionized water and stored. The composite of the samples were made for each sewage area.

The vegetable solution were analyzed for Zn, Pb and Cd using a Atomic Absorption Spectrophotometer (AAS Perkin Elmer modal).A certified standards reference materials was used to ensure accuracy and the analytical values were within the range of certified value.

RESULTS AND DISCUSSION

Concentration of Heavy Metals in Vegetables

Table 1 shows the mean concentration of heavy metals investigated in leafy vegetable (Spinach) commonly consumed in Allahabad. The values are given as concentration of mean in three replicates. The heavy metal levels determined were based on plant dry weight. Lead was not detected in vegetable in all the sewage area. Sample from sewage area (four sites) showed lower concentrations of 0.028 mg/kg for Cd and Naini sewage area 0.094 mg/kg (Cd), all the values were lower than the safe limit for Cd (0.2mg/kg).

Levels of Zn was highest in Baxi Bandh sewage plant with mean concentration of 0.84 mg/kg and lowest in Phaphamou sewage area with mean concentration 0.34 mg/kg. This is within safe limit with respect to FAO/WHO-Codex alimentarius commission,2001 (99.40mg/kg).Our study has shown that the concentrations of Cadmium and Zinc in local sewage irrigated area in Allahabad.

Cadmium is a non-essential element in foods and natural waters and it accumulates principally in the kidneys and liver (Divrikli *et al.*, 2006). Various sources of environmental contamination have been implicated for its presence in foods (Adrino 1984). Lead is a toxic element that can be harmful to plants, although plants usually show to the ability to accumulate large amount of Lead without visible changes in their appearance or yield. Lead is a well-known neurotoxin.

Table 1: Mean concentration of heavy metals in vegetable collected from different locations (mg/kg dry weight).

Location	Cadmium (Cd)	Zinc (Zn)	Lead (Pb)
PhaphamouSewage area	0.028	0.34	ND
Naini sewage area	0.094	0.72	ND
Rasulabad sewage area	0.052	0.68	ND
Buxi Bandh sewage area	0.056	0.84	ND

Lead accumulation in the skeleton and its mobilization from bones during pregnancy and lactation causes exposure to fetuses and breastfed infants. In many plants, Pb accumulation can exceed several hundred times the threshold of maximum level permissible for human. High accumulation of lead, chromium and cadmium in leafy vegetable due to atmospheric deposition have been reported by Voutsa et al,. (1996). According to FAO/WHO, the safe limit for Cd consumption in vegetable is 0.2mg/kg (Table 1). The contents of both Cadmium and Zinc reported in this study are generally lower than the permissible levels by FAO/WHO in vegetable. Among all heavy metals, Zinc is the least toxic and essential element in human diet as it require to maintain the functioning of the immune system. Zinc deficiency in the diet may be highly detrimental to human health then too much Zinc in the diet. The recommended dietary allowance for Zinc is 15mg/day for men and 12mg/day for women (ATSDR 1994a) but high concentration of Zinc in vegetable may cause vomiting, renal damage, cramps. Lead is a serious cumulative body poison which enters into the body system through air, water and food and cannot be removed by washing fruits and vegetables (Divrikli *et al.*, 2003). The high levels of lead in some plants may probably be attributed to pollutants in irrigation water, farm soil or due to pollution in highways traffic (Qui *et. al.*,2003).

CONCLUSION

Generally, the levels of heavy metals were observed to be lower in sewage irrigated area in Allahabad. This may be due to the partly to the absence of pollution in the area under investigation.

REFERENCES

Adrino, D.C. (1984). Trace metal in the Terrestrial Environment.New York:Verlag Spiegler.

Divrikli, U.; Saracoglu, S.; Soylak, M. and Elci, L. 2003. Determination of trace heavy metal contents of green vegetables samples from Kayseri-Turkey by flame atomic absorption spectrometer. Fresenius Environ. Bull. 12:1123-1125.

Divrikli, U.; Horzun, N.; Soylak, M.; and Elci, L. (2006). Trace heavy metal contents of some spices and herbal plants from western Anatollia, Turkey. *Int.J. Food Sci Technol.* 41:712-716.

Kanwar, J.S. and Sandha, M.S. (2000). Agricultural Reviews, 21, 133.

Marshall, 2004. Enhancing food chain integrity: Quality assurance mechanism for air pollution impacts on fruit and vegetable systems. Crop Post Harvest Program, Final Technical Report (R7530).

N.E. James, 1971. Laboratory chemical analysis, In water, and waste waste water technology, 2nd Ed. John Wiley &Sons . New York, pp 30-46.

Vontsa, D. Grimanis, A. Samara, C. 1996 . Trace element in vegetable grown in industrial areas inrelation to soil and air particulate matter, Environmental Sollution, 94, 325-435.

Qui, XX; Huang, D.F.; Cai, S.X.; Chen, F.; Ren, Z.G. and Cai, Y.C. 2000. Investigation on vegetables pollution and pollution sources and its control in Fuzhou, Fujian Province. Fujian *J. Agric. Sci.* 15:16-21.

Journal of Natural Resource and Development 4(2):78-86, 2009

EFFECT OF DIFFERENT LEVELS OF BAVISTIN, WAXOL AND THEIR INTERACTION ON SHELF LIFE AND QUALITY ON GUAVA FRUIT *(PSIDIUM GUAJAVA)* CV. APPLE COLOUR IN ROOM TEMPERATURE

Praveen Kumar Nishad, Balaji Vikram and V. M. Prasad

Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences. (Deemed University), Allahabad-211007(U.P.)

ABSTRACT

Guava cv. (Apple colour) is a Commercial fruit crop for the grower in Indian. Its is very economically fruit for Fruit industry and many home bases products prepared by farmers its also used in table purpose, But we know its self life is poor. Due to its waste causes many economic problems. The aim of this study is to improve the self life of the fruit by different chemicals composition, Waxol Percentages and packaging materials. The present investigation entitled "Effect of shelf life and quality on guava fruit (Psidium guajava) cv. Apple colour in Room temperature. There were ten post harvest treatment and one storage condition i.e (Room temperature). Name of chemical use - Bavistin (0%), (0.1%) and (2%) and Wax (0%), (6%) and (8%). Their effects were accessed by complete randomized design with three replication. The treated fruit of Guava were stored at room temperature. There was decrease in vitamin C (mg) and acidity during storage period of guava fruit under room temperature. There was increase in TSS and juice pH. Physiological loss in weight of fruit increased in storage period Irrespective of post harvest treatment and room temperature. All the treatments were found better in respect of TSS & ascorbic acid content over Control. On the basis of results obtained the treatment combination T4 (Waxol (6%) + Bavistin (0.2%) proved to be the best in terms of fruit quality and better shelf life at room temperature. Since these finding are based on one year trial.

Key Words: *Guava, Waxol, polythene bags, Carbendazim and LDPE.*

Guava (Psidium guajava) is an evergreen sub tropical fruit crop and belongs to the family Myrtaceae. It is one of the common and major fruit crops of India and considered fourth most important in area and fifth in production. In India, it occupies an area of 1.62 million hectors with an annual production of 16.85 million tones accounting for 5.26 percent and 3.73 percent of area and production respectively. It is rich in vitamin 'C' (300mg\100g.) and good sources of calcium, phosphorous, pantothenic acid, riboflavin, thiamine and niacin. It can be canned with sugar or used for making fruit like mango, apple etc, are not available in the market. It is also known as the "apple of tropics." It is a climatic fruit and highly perishable in nature and should be marketed immediately after harvest. The short post- harvest life of horticultural crop is due to their highly perishable nature and physiological break down during handling, transport, storage and these losses are further enhanced by infection of post harvest disease. Various viable technologies for improving shelf-life and storage of horticulture commodities have evolved during the post decades: antitranspirants, wax coating, growth retardants and different type of packing material etc. increase the shelf- life of harvested fruits. The technology holds considerable promise because in many cases it has an edge over the conventional methods. It could be applied judiciously where conventional methods are inadequate, uneconomical or pose potential health risks. It can also be used as a complementary process with

Table 1. Treatment combination

S.No.	Symbol	Treatment combination
1	T_0	Control
2	T_1	Bavistin (0.1%) + Waxol (0%)
3	T_2	Bavistin (0.2%) + Waxol (0%)
4	T_3	Bavistin (0%) + Waxol (6%)
5	T_4	Bavistin (1 %) + Waxol (6%)
6	T_5	Bavistin (2%) + Waxol (8%)
7	T_6	Bavistin (0.%) + Waxol (6%)
8	T_7	Bavistin (0.1%) + Waxol (8%)
9	T_8	Bavistin (0.2%) + Waxol (8%)

many new and emerging technologies. The process helps in reducing chemical burden on the commodities and also increases the packaging possibilities. But in spite of these available techniques the percentage of post harvest losses of fruit is still high. Therefore, there has to be a standardization of techniques for reducing this post harvests losses in the produce thereby, maintaining the quality of the product. The techniques should be feasible, economically viable and easily affordable to the average growers. It should also be feasible from the health point of view of human beings, Hussain, et al. (1991). Irradiated foods are wholesome and nutrition. All known methods of foods processing and even storing even storing foods at room temperature for a few hours after harvesting can lower the content of some nutrients, such as vitamins, Aradhita, et al. (1995). At low doses of radiation, nutrient losses are either not measurable or, if they can be measured, are not significant. Sometimes higher doses are used to extend shelf life or control harmful bacteria, nutrition losses are less than or about the some as cooking and freezing.

MATERIALS AND METHODS

The present investigation entitled "Effect of post harvest treatment on shelf life and quality of Guava fruit (Psidium guajava) cv. Apple colour ." was conducted at post Harvest Laboratory. Department of Horticulture, Allahabad Agricultural Institute-Deemed University, Allahabad during the year 2008-09. The experiment was laid out in a C.R.D. with ten treatment, each replication thrice, keeping unit per treatments. The treated fruit of Guava were stored at room temperature.

Bavistin and waxol was applied on a guava fruits and packed in a polythene bags to extend the shelf life. Regular observation were taken at 4 days interval on physiological loss in diameter of fruit, specific gravity of fruit, T.S.S., acidity and vitamin C.

RESULTS AND DISCUSSION

The results of the experiment conducted on the effect of post harvest treatment on shelf life and quality of Guava fruit (Psidium guajava) cv. Apple colour., have been presented in detail.

Diameter of fruit (%):

It is clear from table 1 that the effect of different levels of Waxol, and interaction (waxol+Bavistin) was significant right from 0, 4, 8 & 12 days of storage. Minimum physiological loss in weight was recorded with the treatment combination T0 (Bavistin (0.%) + Waxol (0%) i.e. 6.60, 5.90, 5.65 and 5.20 at 0, 4, 8 and 12 days of storage respectively which is followed by T1 (Bavistin (0.1%) + Waxol (0%) i.e. 6.63, 6.23, 5.78 and 5.31. Maximum physiological loss in weight was recorded with the treatment combination T5 (Bavistin 0.2% + Waxol 6%).

Similar results were recorded by Teaotia, et al. (1968) and Jagdeesh, S.L. (1994).

Table 1 Effect of different levels of bavistin, waxol and their interaction on diameter (cm) of guava fruit cv. Apple Colour at different days of storage at ambient temperature

Bavistin (B)	Waxol (W)				Waxol (W)			
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	Mean (B)	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	Mean (B)
	0 Day				4th Day			
B_0 (0.0%)	6.60	6.83	6.93	6.79	5.90	6.37	6.43	6.23
B_1 (0.1%)	6.63	7.71	7.10	7.15	6.23	6.77	6.58	6.53
B_2 (0.2%)	6.67	7.60	7.07	7.11	6.23	6.73	6.57	6.51
Mean (W)	6.63	7.38	7.03	-	6.12	6.62	6.53	-
		F - Test	S. Ed. (±)	C. D. at 5%		F - Test	S. Ed. (±)	C. D. at 5%
Bavistin (B)		NS	-	-		S	0.010	0.022
Waxol (W)		NS	-	-		S	0.010	0.022
Interaction (B x W)		NS	-	-		S	0.018	0.038
	8th Day				12th Day			
Bavistin (B)	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	5.65	5.99	6.00	5.88	5.20	5.35	5.38	5.31
B_1 (0.1%)	5.78	6.35	6.30	6.14	5.31	5.95	5.50	5.59
B_2 (0.2%)	5.98	6.30	6.15	6.14	5.35	5.85	5.50	5.57
Mean (W)	5.80	6.21	6.15	-	5.29	5.72	5.46	-
		F - Test	S. Ed. (±)	C. D. at 5%		F - Test	S. Ed. (±)	C. D. at 5%
Temperature (TE)		S	0.005	0.011		S	0.019	0.040
Time (T)		S	0.005	0.011		S	0.019	0.040
Interaction (TE x T)		S	0.009	0.019		S	0.033	0.070

Table 2 Effect of different levels of bavistin, waxol and their interaction on specific gravity of guava fruit cv. Apple Colour at different days of storage at ambient temperature

Bavistin (B)	0 Day				4th Day			
	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	1.01	1.11	1.12	**1.08**	0.91	1.02	1.02	**0.98**
B_1 (0.1%)	1.03	1.34	1.16	**1.18**	0.95	1.15	1.05	**1.05**
B_2 (0.2%)	1.10	1.27	1.13	**1.17**	0.96	1.12	1.04	**1.04**
Mean (W)	**1.05**	**1.24**	**1.14**	-	**0.94**	**1.10**	**1.04**	-
		F - Test	**S. Ed. (±)**	**C. D. at 5%**		**F - Test**	**S. Ed. (±)**	**C. D. at 5%**
Bavistin (B)		NS	-	-		S	0.005	0.010
Waxol (W)		NS	-	-		S	0.005	0.010
Interaction (B x W)		NS	-	-		S	0.008	0.017

Bavistin (B)	8th Day				12th Day			
	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	0.81	0.92	0.94	**0.89**	0.62	0.78	0.82	**0.74**
B_1 (0.1%)	0.86	1.08	0.95	**0.96**	0.71	1.01	0.90	**0.87**
B_2 (0.2%)	0.88	1.06	0.94	**0.96**	0.75	0.98	0.89	**0.87**
Mean (W)	**0.85**	**1.02**	**0.94**	-	**0.69**	**0.92**	**0.87**	-
		F - Test	**S. Ed. (±)**	**C. D. at 5%**		**F - Test**	**S. Ed. (±)**	**C. D. at 5%**
Temperature (TE)		S	0.004	0.009		S	0.004	0.008
Time (T)		S	0.004	0.009		S	0.004	0.008
Interaction (TE x T)		S	0.007	0.015		S	0.006	0.013

Table 3 Effect of different levels of bavistin, waxol and their interaction on total soluble solids (%) of guava fruit cv. Apple Colour at different days of storage at ambient temperature

Bavistin (B)	0 Day				4th Day			
	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	10.46	11.77	11.80	**11.34**	10.02	11.33	11.35	**10.90**
B_1 (0.1%)	11.70	12.49	12.27	**12.15**	11.31	11.65	11.43	**11.46**
B_2 (0.2%)	11.70	12.49	11.85	**12.01**	11.32	11.65	11.37	**11.45**
Mean (W)	**11.29**	**12.25**	**11.97**	-	**10.88**	**11.54**	**11.38**	-
		F - Test	**S. Ed. (±)**	**C. D. at 5%**		**F - Test**	**S. Ed. (±)**	**C. D. at 5%**
Bavistin (B)		NS	-	-		S	0.02	0.04
Waxol (W)		NS	-	-		S	0.02	0.04
Interaction (B x W)		NS	-	-		S	0.03	0.06

Bavistin (B)	8th Day				12th Day			
	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	8.26	9.76	9.83	**9.28**	6.70	7.17	7.66	7.18
B_1 (0.1%)	9.23	10.16	10.16	**9.85**	6.95	8.86	8.39	**8.07**
B_2 (0.2%)	9.65	10.16	9.90	**9.90**	6.95	8.86	8.12	7.98
Mean (W)	**9.05**	**10.03**	**9.96**	-	**6.87**	**8.30**	**8.06**	-
		F - Test	**S. Ed. (±)**	**C. D. at 5%**		**F - Test**	**S. Ed. (±)**	**C. D. at 5%**
Temperature (TE)		S	0.02	0.04		S	0.03	0.07
Time (T)		S	0.02	0.04		S	0.03	0.07
Interaction (TE x T)		S	0.04	0.07		S	0.06	0.12

Table 4 Effect of different levels of bavistin, waxol and their interaction on acidity (%) of guava fruit cv. Apple Colour at different days of storage at ambient temperature

Bavistin (B)	0 Day				4th Day			
	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	0.89	0.60	0.57	**0.69**	0.86	0.56	0.53	**0.65**
B_1 (0.1%)	0.80	0.32	0.33	**0.48**	0.75	0.28	0.29	**0.44**
B_2 (0.2%)	0.75	0.33	0.56	**0.55**	0.72	0.29	0.52	**0.51**
Mean (W)	**0.81**	**0.42**	**0.49**	-	**0.78**	**0.38**	**0.45**	-
		F - Test	**S. Ed. (±)**	**C. D. at 5%**		**F - Test**	**S. Ed. (±)**	**C. D. at 5%**
Bavistin (B)		S	0.077	0.163		S	0.003	0.007
Waxol (W)		S	0.077	0.163		S	0.003	0.007
Interaction (B x W)		NS	-	-		S	0.005	0.011

Bavistin (B)	8th Day				12th Day			
	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	0.91	0.75	0.67	**0.78**	0.72	0.35	0.26	**0.44**
B_1 (0.1%)	0.82	0.34	0.48	**0.55**	0.48	0.12	0.24	**0.28**
B_2 (0.2%)	0.81	0.35	0.60	**0.59**	0.46	0.24	0.26	**0.32**
Mean (W)	**0.85**	**0.48**	**0.58**	-	**0.55**	**0.24**	**0.25**	-
		F - Test	**S. Ed. (±)**	**C. D. at 5%**		**F - Test**	**S. Ed. (±)**	**C. D. at 5%**
Temperature (TE)		S	0.004	0.008		S	0.002	0.005
Time (T)		S	0.004	0.008		S	0.002	0.005
Interaction (TE x T)		S	0.006	0.013		S	0.004	0.009

Table 5 Effect of different levels of bavistin, waxol and their interaction on vitamin C (ascorbic acid) (mg/100 g pulp) of guava fruit cv. Apple Colour at different days of storage at ambient temperature

Bavistin (B)	0 Day				4th Day			
	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	181.38	191.66	191.80	**188.28**	176.66	184.49	187.59	182.91
B_1 (0.1%)	183.83	205.17	199.68	**196.23**	178.83	199.46	193.33	190.54
B_2 (0.2%)	190.22	200.10	198.27	**196.20**	183.83	193.75	191.25	189.61
Mean (W)	**185.14**	**198.98**	**196.58**	-	**179.77**	**192.57**	**190.72**	-
		F - Test	**S. Ed. (±)**	**C. D. at 5%**		**F - Test**	**S. Ed. (±)**	**C. D. at 5%**
Bavistin (B)		NS	-	-		S	0.86	1.81
Waxol (W)		NS	-	-		S	0.86	1.81
Interaction (B x W)		NS	-	-		S	1.49	3.13

Bavistin (B)	8th Day				12th Day			
	Waxol (W)			Mean (B)	Waxol (W)			Mean (B)
	W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)		W_0 (0.0%.)	W_1 (6.0%.)	W_2 (8.0%.)	
B_0 (0.0%)	146.08	161.69	163.08	**156.95**	122.02	129.52	134.63	128.72
B_1 (0.1%)	153.95	173.25	170.19	**165.80**	124.79	153.92	147.53	142.08
B_2 (0.2%)	157.73	171.84	164.26	**164.61**	129.06	152.53	138.56	140.05
Mean (W)	**152.59**	**168.93**	**165.84**	-	**125.29**	**145.32**	**140.24**	-
		F - Test	**S. Ed. (±)**	**C. D. at 5%**		**F - Test**	**S. Ed. (±)**	**C. D. at 5%**
Temperature (TE)		S	0.74	1.55		S	0.61	1.29
Time (T)		S	0.74	1.55		S	0.61	1.29
Interaction (TE x T)		S	1.28	2.69		S	1.06	2.23

Specific gravity :

It is clear that table 2 that the effect of different levels of Waxol, and interaction (waxol+Bavistin) was significant right from 0, 4, 8 and 12 days of storage. Whereas the interaction of different levels of (Waxol + Bavistin) was non-significant at 0, 4, 8 and 12 days of storage. Maximum specific gravity was recorded with the treatment combination T4 (Waxol (6%) + Bavistin (0.1%) i.e. 1.34, 1.15, 1.04 and 1.01 at 0, 4, 8 and 12 days of storage which is followed by T5 (Waxol (6%) + Bavistin (0.2%) and minimum specific gravity was recorded with the treatment combination T1 (Waxel 0%) + Bavistin (0.0%). Similar results were recorded by Shanker et al. (1967b).

Total soluble solids (%):

It is clear that table 4 the effect of different levels of waxol, bavistin and interaction (Waxol + Bavistin) was significant fifth from 0, 4, 8 & 12 day of storage.

Maximum total soluble solid was recorded with the treatment combination T4 (Waxol (6%) + Bavistin (0.1%) i.e. 12.49, 11.65, 10.16 and 8.86 at 0, 4, 8 and 12 days of storage which is followed by T7 (Waxol (1%) + Bavistin (0%) and minimum total soluble solid was recorded with the treatment combination T0 (Waxol (0%) + Bavistin (0.0%). This result was also in agreement with the work of Singh et al. (1976).

Acidity:

It is clear that table no. 6 that the effect ofdifferent levels of waxol Bavistin and interaction (waxol + Bavistin) was significant right from 0, 4, 8 and 12 days of storage. All the treatment showed significant different for different interval of storage periods. Maximum acidity (0.72) was recorded with the treatment combination T0 (waxol 0.1% + Bavistin 0%) followed by other treatment and minimum acidity (0.12%) was recorded with the treatment combination T4 (waxol 6% + Bavistin 0%). This finding was supported by Singh et al. (1985) and Chen et al. (2001).

Ascorbic acid (Vitamin C) content (mg/100g) :

It is clear that table 7 that the effect of different levels of waxol, Bavistin and interaction (Waxol + Bavistin) was significant right from 0, 4, 8 & 12 days during storage. All the treatment showed significant difference for different interval of storage periods. Maximum vitamin C was recorded with the treatment combination T4 (Waxol (6%) + Bavistin (0.1%) i.e. 205.17, 199.46, 173.25 and 153.92 at 0, 4, 8 and 12 days which is followed by T5 (Waxol (6%) + Bavistin (0.2%) and minimum vitamin C was recorded with the treatment combinationT0 (Waxol (0%) + Bavistin (0.0%). This finding was supported by Ylagan. M.M. (1961). Singh et al. (1989)

On the basis of results obtained the treatment combination T4 (Waxol (6%) + Bavistin (0.2%) proved to be the best in terms of fruit quality and better shelf life at room temperature.

Since these finding are based on one year trial and therefore, further experiment may be done to substantiate the results.

REFERENCES

Aradhita, B., Gupta, O.P. and Dhawan, S.S. (1995). Evaluation of guava (Psidium guajava L.) hybrids for making nectar. Haryana J. Hort. Sci., 24(20): 102-109.

Chen, W. and Zhang, F. (2001). The formed and physiological changes of guava fruit juice during post-harvest storage. Plant Physiology, Communications, 37(1): 25-26.

Jagdeesh, S.L., (1994) studies on the storage of guava fruit. M.Sc (Agri) Thesis, univ. Agric. Sci. Dharwad.

Hussain, A. and Shah, W.H. (1991). Preparation and evaluation of Guava products (Squash, Cheese, jelly, pickle and chutney). Pakistan Journal of Agricultural Research, 12(2): 106-111.

Shanker, G., Srivastava, K.K. and Das, C.O. (1967b). Physico-chemical studies of guava varieties of Uttar Pradesh. Allahabad Farmers, 41: 7-16.

Singh, K.D., Islam and Verma, O.P. (1976). Process

ing and storage of carbonated guava bever age. J. Food Processing and Preservation (USA), 20(1): 79-86.

Singh, Rita, Kapoor, A.C. and Gupta, O.P. (1985). The effect of cultivars, seasons and storage on the nutritive value and keeping quality of guava cheese. Indian Food Packer, 71-77.

Singh, A.K. (1989). Studies on preparation and storage of Guava (Psidium guajava L.) beverage. Thesis, N.D. Univ. of Agri. and Tech. Faizabad.

Teaotia, S.S., Pandey, I.C., Agnihotri, B.N. and Kapour, K.L. (1968). Studies of some guava varieties (Psidium guajava L.) of U.P. Indian Agriculturist, Vol.VI, No. (1-2): 47-53.

Ylagan, M.M. (1961). Ascorbic acid content of some guava fruit juice. Philippine Agric. (44): 477-478.

Journal of Natural Resource and Development 02(2007) 01-07, 2007

MACRO AND MICRO NUTRIENTS AND NUTRITIONAL STATUS OF ORGANIZED AND UNORGANIZED MALE LABORS OF ALLAHABAD

Vikas Pandey and Reena Chaturvedi
Centre of Food Technology, University of Allahabad - 211002, (U.P.) India

ABSTRACT

The present study aimed to compare the macro and micronutrients intake and the nutritional status of male laborers belonging to the organized and unorganized sectors. A sample of 108 laborers was drawn through stratified random sampling. Gang men as organized and blacksmith as unorganized laborers were selected from Allahabad district of Uttar Pradesh. Significant difference (p d" 0.05) was found between the organized and unorganized laborers for the intake of energy, protein, carbohydrate, iron and calcium. A significant association (χ^2 = 19.67) was found between the categories of the laborers and their nutritional status. It is concluded from the study that the organized laborers have better macro and micronutrients intake and nutritional status due to their regular income and better meal pattern as compared to the unorganized laborers, who receive very low income due to their irregular employment and hence are unable to afford proper amount of food in their day to day life.

Key Words: *Macronutrients, micronutrients, nutritional status, organized laborers, unorganized laborers.*

Nutrition plays a major role in the maintenance of human health (Donalsol 2004, Hung *et.al.* 2004). The laborers who indulge in heavy work have to maintain a good state of health and productive efficiency; hence their daily nutrition should be properly balanced and adequate (Gallis and Pangopoulou 2007).

Eating behavior of the people is generally influenced by their socioeconomic status and the life style which in turn affects their body mass index (BMI). The low intake of nutrient and energy may cause under nourishment which reflects as low BMI. An increase in BMI may be due to intake of fat (Kant *et.al* 1995), fast food (Duffey *et.al* 2007) and soft drinks (Rostrollo *et. al.* 2006).

Energy intake and its expenditure plays equally important role in maintaining the nutritional status. If the daily energy intake is lower than the energy expenditure it results in negative energy balance as summarized by some studies in an international labor office publication (Apund *et.al* 1989). Obesity is an outcome of positive energy balance, while exercise is one of the major factors for preventing weight gain (Droyvold *et.al* 2004) and sleeping (Hasler *et.al.* 2004) is associated with obesity.

MATERIALS AND METHODS

The cross-sectional study was conducted on two comparative groups of male laborers belonging to organized and unorganized sector in Allahabad. The Survey was conducted on selected areas and stratified sampling was applied to draw the sample of 108 male laborers involved in heavy work. Gang men were taken as organized group and woodcutter were taken as unorganized group. A comprehensive questionnaire (Willet *et.al*, 1985; Thompson and Byers1994; Black *et.al* 2001) with few modifications was used to record the general information (Apund *et.al* 1989; Thompson and Byers 1994; Black AE et.al 2001). Food

frequency questionnaire was used to record consumption pattern of different food groups. 24 hrs dietary recalls for three days of the laborer was taken to determine their calorie and nutrient intake. Weight and height of the individuals were recorded to calculate BMI.

Statistical Package for Social Sciences (SPSS user guide. 2004) was used to analyze the data. The t test was applied to analyze the significant difference in the macro and micronutrients intake of the two groups. The χ^2 test was applied to find significant association between the categories of laborers and their nutritional status.

RESULTS AND DISCUSSION

NUTRIENTS INTAKE PATTERN

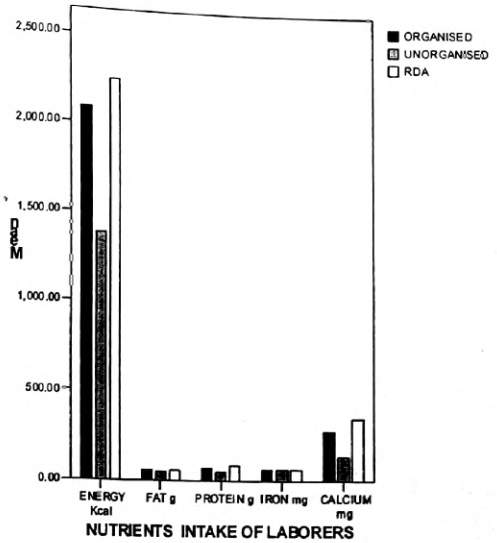
Man needs a wide range of nutrients to perform various functions through the body and to lead a healthy life (Gopalan.and Balasubramanian, 2000). The laborers, who are involved in heavy work, essentially require more nutrients and energy to remain fit and to perform efficiently. Their nutritional status is directly affected by their energy intake and expenditure. A significant difference was found between the comparative groups regarding macro and micronutrients intake, however the mean intake of micro and macronutrients of both the groups were less than RDA (Recommended dietary allowance). The unorganized were taking less macro and micronutrients than organized group. The gang men as organized laborers were having almost proper meal and diet with a consistent quality and quantity on regular basis due their fixed and better income pattern and hence their macro and micronutrients intake was much better than that of unorganized laborers like wood cutters who could not afford to have a regular and proper meal due to their low and irregular income. The intake of macronutrients such as carbohydrate, fat and protein in unorganized laborers were found significantly lower than that of organized laborers. The intake of micronutrients such as iron and calcium in unorganized laborers were found significantly lower than that of organized laborers. The observed intake pattern of nutrients of the two comparative groups was the consequence of the actual amount of food consumed by them, while gang men were consuming regular and almost proper amount

Table 1: Shows that there is significant difference between organized and unorganized labors regarding their intake of energy, protein, fat, iron and calcium.

NUTRIENTS	CATEGORIES OF LABORS	MEAN	Std. Deviation	t
ENERGY 3800C/day)	ORGANISED	3474.36	20.459	6.594 *
	UNORGANISED	2111.84	32.195	
FAT (20g)	ORGANISED	22.64	2.789	15.017 *
	UNORGANISED	14.27	2.620	
PROTEIN (60g)	ORGANISED	55.18	3.607	11.575 *
	UNORGANISED	40.78	7.595	
IRON(28 mg)	ORGANISED	28.62	5.867	2.585 *
	UNORGANISED	21.88	6.304	
CALCIUM (400 mg)	ORGANISED	350.98	29.310	5.921 *
	UNORGANISED	173.76	38.941	

$p \leq 0.05$ * Significant

GRAPH 1: MEAN NUTRIENTS INTAKE OF ORGANIZED AND UNORGANIZED LABORERS AND RDA



through better sources of cereals, pulses, fat, milk, and vegetables in their daily diet, the wood cutters were either having lesser amount of vegetables and grains or were completely deprived of such foods as milk fruits etc.

The difference in nutrients intake is due to the difference in economic status of the two comparative groups of laborers. The difference in iron intake is due to difference in the consumption of green vegetables by the two groups. The organized group could afford to take more green vegetables and seasonal fruits, which are especially rich in vitamin C and hence promote the bioavailability of iron in the body. The unorganized groups who could not afford sufficient amount of green vegetables and fruits due to low income therefore their iron intake is very low.

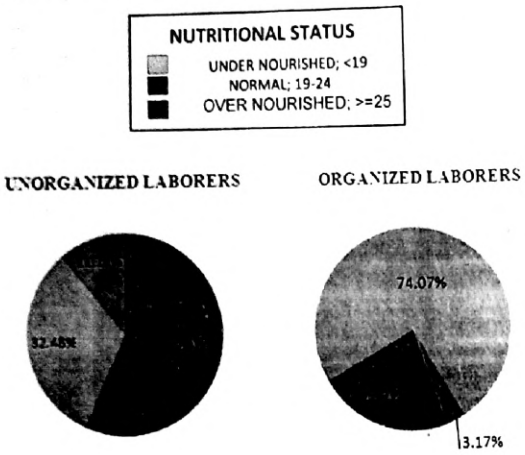
It is clear from the bar graph that the mean intake of energy, protein and calcium of both the

Table 2 : Shows the nutritional status

CATEGORIES OF LABORERS	NUTRITIONAL STATUS UNDER NOURISHED (<19)	NORMAL (19-24)	OVER NOURISHED (>25)	Total	χ^2
ORGANIZED	17	31	6	54	19.67*
UNORGANIZED	40	12	2	54	
TOTAL	57	43	8	108	

* Significant

PIE CHART 1 : SHOWING NUTRITIONAL STATUS



groups is lower than RDA. Both the groups are consuming less amount of food in their meals. Organized laborers are taking better diet including all food groups as compared to unorganized laborers. There is a need to propagate nutritional awareness among to enable them for their food and nutritional management.

NUTRITIONAL STATUS

The nutritional status exhibits overall fitness of the body. It is an outcome of the consumption pattern and nutrient intake of individuals. It is the condition of health which not only influenced by the amount and the quality of nutrients intake but also by the utilization of nutrients within the body. In case of adults, nutritional adequacy is assessed by measuring their weight and height; and is expressed as body mass index, which is the ratio of weight (kg) to the square of height (m).

It is clear from the Table 2 that there are more undernourished and less normal cases in unorganized category than organized one. There are more cases of overweight in organized category. The meal pattern of the gang men is regular and they are taking proper amount of nutrients in their diet as compared to the wood cutters. The gang men are consuming more fat in the form of fried food which is main source of energy and hence more of them are either normal or overweight as compared to the other group. The unorganized laborers neither having regular meal nor sufficient diet and hence their intake of energy and nutrients is low therefore more of them are undernourished as compared to the normal. Very few cases of unorganized laborers were overweight.

Because of the dearth of research on the food and nutrient intake and the status of the laborers, the comparison of the observed findings of the present study with the findings of the other similar studies could not be possible. However in view of the above results and discussion some recommendations can be made such as nutritional awareness and health care education should be spread in the communities to motivate people for proper meal pattern and healthy eating practices. They should be encouraged to have low cost nutritious foods and not to use the alcohol. Diet counselling should be imparted individually to the workers with the help of visual aids like charts, pamphlets, exhibition and telecommunication. They should be given regular employment with consistent income so that they can afford to include variety in their diet including different types of cereals like rice, wheat, coarse grains, pulses (legumes) fresh fruits, fibrous vegetables, milk, curd, salads. They should be given the awareness for sanitary and hygienic conditions of kitchens and dining area, personal hygiene and safe handling the food and also about the consequences of over-eating, and obesity.

REFERENCES

Apund, EB.; Bostrand,L.,Mobbs, ID.,Bernt-Strehle, A.,1989.Guide line on ergonomic study in forestry, Geneva :International labour office.

Bes-Rasrollo, M.; Sancher-villegas,A., Gomez-Gracia,E., Martinez ,JA., Pajars, RM., Martinez-Gonzalez,MA.,2006.Predictors of de navarra study.Am J Clin Nutr ; 83: 362-70.

Black,AE.;2001.Dietary assessment for sports dietics Nutr Bull;26: 29.

Gopalan,C. and Balasubramanian.,2000.Nutritive value of Indian food.(Book) Published by National Institute of Nutrition Hyderabad.

Donalson, MS.; 2004.Nutrition and cancer: a review for the evidence for anti cancer diet. J Nutr ; 3:1-21.

Droyvold, WB.; Holmen J.,Kruger, O.,Midthjell, K.,2004.Leisure time physical activity and change in the body mass index : an 11- year follow-up study of 9357 normal weight healthy women 20-49 year old . J Women health; 13:55-62.

Duffey, KJ.; Gordon–Larsen. P.,Jacobs. DR., Williams, O.,Papkin,BM., 2007. Differential association of fast food and restaurant food consumption with 3-y change in the body mass index : The coronary artery risk development in young adults. Am J Clin Ntur 2007;85 : 201-8.

Gallis,C.;Pangopoulou,P., 2007.Nutrient intakes of greek forest workers and researchrs do not meet all references dietary intake .Science direct nutrition research; 27: 321-326.

Hasler,G.; Bujsse,DJ., Klaghofer,R., Gamma,A., Ajdacic,V., Eich, D., et.al. 2007. The association between short sleep duration and obesity in young adults:a 13- years prospective study. 27:661-6.

Hung,HC.; Jashipura,KJ., Jiang,R.,Hu,FB.,Hunter,D ,Smith-WarnerSA.,2004. Fruit and vegetable intake and risk of major major chronic diseases. J Nat Cancer Inst; 96(21):1577-84.

Kant, AK.; Graubard,BI.,Schatzkin, A., Ballard-Barbash .,1995. Energy intake from fat and subsequent weight change in the NHANES I epidemiological follow-up study . Am J Clin Nur ;61:11-17.

SPSS Inc. SPSS user guide. 2004. Release 12.0.Chicago, Illinois.

Thompson, FE.; and Byers. T., 1994.Dietary assessement resource manual. J Nutr; 124:2245S-317S.

Willet, WC.;Sampson,L., Stampfer,MJ., Rosner,B., Bain,C., witschi,J., et.al.1985. Reproducibility and validity of a semi quantitative food frequency questionnaire. Am J Epidemiol;51:51-65.

Journal of Natural Resource and Development 4(2):92-102, 2009

DIRECTION OF TEA INDUSTRY IN INDIA AND EXPORT DESTINATION

K. K. Singh, Pramod Kumar* and S. K. Singh
Department of Agricultural Economics, U.P. College, Varanasi - 211002
**Division of Agricultural Economics, I.A.R.I., New Delhi - 110012*

ABSTRACT

India is the largest producer and consumer of tea in the world and accounts for around 27 per cent of world production and 13 per cent of world trade. Export of tea is around 20 per cent of domestic production. The bulk (75 to 80 %) of tea production comes from Northern India, Assam and West Bengal being the major contributors. In recent years, however, India's long-standing predominance in the world market as the largest producer and exporter of tea has taken a beating due to sluggish growth in production coupled with slow ascendancy in domestic consumption (Mitra, 1991). India's share in world exports of tea has also drastically declined indicating that India is unable to take advantage of the expanding world market. To add to the woes of the tea firms and farmers is the falling prices of tea both in domestic and international markets. These changes would have an adverse impact on the economy. It is pertinent to assess the performance of tea sector and identify ways and means of overcoming the problems. The study estimated the comparative advantage in tea trade with the help of Export Performance Ratio (EPR) , using data from FAOSTAT for the period 1995-2004 .The EPR of the tea during a period can be expressed as a ratio of share of exports for tea of the country to the world to the share of total exports of the country to world for all the commodities .If EPR is greater than unity ,the country has comparative advantage in the export of that commodity and vice versa (Balassa,1965).The comparative advantage was also studied using the net protection Coefficient (NPC) which is given as the ratio of domestic price tea .The NPC less than 1 means the country is competitive in that commodity.India is second in terms of both area (20 per cent) and production (25 per cent) of tea in the world (Table 4.26). Six countries i.e., India, china, Kenya, Sri Lanka, Turkey and Indonesia together account for 80 per cent of the world's total tea production. The productivity of tea in India is less than that of Kenya (2.15 tones/ ha), Japan (1.98 tones/ha), and Turkey (1.82 tones/ha). It is also observed that in the last decade and a half the country has not recorded any significant growth in yield (0.23 per cent). Though tea production has increased over the years due to expansion in its area, further increase in production is possible only by way of increasing yield. The fall in price of tea was observed both in India as well as world over. The tea prices recorded in Mombasa (Kenya) in 2005 were same as that recorded about a decade ago. Tea prices in India and all over the world have not shown an increasing trend. Nevertheless immense variability in prices was observed in the past decade. Moreover the Indian prices have always remained lower than (Mombasa) Kenya prices. This phenomenon has effect on the profitability of the industry.Concerted efforts have to be made by different stakeholders to

increase the productivity of tea plantations. The extension services should be strengthened to disseminate the technical know-how to the small tea growers located in remote areas.A new type of production organization and ownership structure may be promoted to look after the multi-pronged problems of production, marketing and supporting services for the small holder tea production.

MATERIALS AND METHODS

Direction of Trade

The data on export of tea and its products were collected for the period 1980 to 2004from various publications of Director General of commercial Intelligence and statistics (DGCI&S)<Ministry of Commerce. Tea leaf in bulk, constitutes 57 percent of total tea exports and therefore ,an in depth assessment of shift in destinations and its future demand was performed taking 10 major tea importing countries. The biannual averages at four yearly interval data for the period 1995-2004 were used to *analyse* the market share for the tea exports.

Comparative Advantage

The study estimated the comparative advantage in tea trade with the help of Export Performance Ratio (EPR), using data from FAOSTAT for the period 1995-2004 .The EPR of the tea during a period can be expressed as a ratio of share of exports for tea of the country to the world to the share of total exports of the country to world for all the commodities .If EPR is greater than unity ,the country has comparative advantage in the export of that commodity and vice versa (Balassa,1965).The comparative advantage was also studied using the net protection Coefficient (NPC) which is given as the ratio of domestic price tea .The NPC less than 1 means the country is competitive in that commodity. (Cuddy and Velle, 1978).

RESULTS AND DISCUSSION

India's status in global Tea Production

India is second in terms of both area (20 per cent) and production (25 per cent) of tea in the world (Table 1). Six countries i.e., India, china, Kenya, Sri Lanka, Turkey and Indonesia together account for 80 per cent of the world's total tea production. The productivity of tea in India is less than that of Kenya (2.15 tones/ha), Japan (1.98 tones/ha), and Turkey (1.82 tones/ha). It is also observed that in the last decade and a half the country has not recorded any significant growth in yield (0.23 per cent). Though tea production has increased over the years due to expansion in its area, further increase in production is possible only by way of increasing yield.

Across the states Assam is the leading state with an area of 2.31 lakh hectares and production of 4.45 lakh tones followed by West Bengal. Tamil Nadu, Kerala and Tripura (Table 2). The productivity is higher in Southern states compared to that of northern states of the country. Tea is produced in almost all the North Eastern states. Assam is the world's largest distinct tea-growing area and produces the instantly recognizable, rich, malty, full-bodied, bright teas that have established themselves as favourites around the world. In West Bengal Darjeeling is known as the 'Champagne of teas'. Darjeeling tea, with its unique Muscatel flavour and exquisite bouquet, is the world's most exclusive tea, fetching the highest prices across the world.

Tripura is categorized as a traditional tea-growing state producing about 7.5 million kg of tea. There is a considerable scope to increase the area under tea plantation as well as productivity. The tea currently produced in Tripura is recognized for its good blending qualities. In Nagaland most of the farmers have shifted towards exclusive tea cultivation instead of mixed crops, which was the tradition. The price received by the farmers, however, is not as satisfactory. People are actually new to this crop and do not know about the market dynamics or quality differences. There is an urgent need for extension support at every level of cultivation and processing.

Declining global prices affecting sustainability of tea industry

Table1: Production of tea in the world

Country		TE 1990	TE 2005	% to total	CAGR (%)	C.V. (%)
China	A	8.44	9.46	(37)	0.65	3.24
	P	5.63	8.62	(26)	2.72	13.56
	Y	0.67	0.91		2.06	10.47
India	A	4.15	5.00	(20)	1.34	7.21
	P	6.88	8.42	(25)	1.56	7.59
	Y	1.66	1.69		0.23	4.43
Indonesia	A	0.91	1.16	(5)	1.72	8.67
	P	1.44	1.69	(5)	0.98	4.76
	Y	1.59	1.45		-0.72	5.19
Japan	A	0.59	0.49	(2)	-1.43	7.04
	P	0.90	0.98	(3)	0.03	3.55
	Y	1.53	1.98		1.49	7.68
Kenya	A	0.90	1.37	(5)	2.52	11.84
	P	1.81	2.95	(9)	3.38	15.72
	Y	1.99	2.15		0.84	4.90
Sri Lanka	A	2.22	2.03	(8)	0.72	6.24
	P	2.22	3.06	(9)	2.81	13.56
	Y	1.00	1.51		3.56	16.97
Turkey	A	0.89	0.92	(4)	0.62	7.41
	P	1.37	1.86	(6)	1.94	14.53
	Y	1.55	1.82		2.55	15.93
Vietnam	A	0.54	1.02	(4)	3.60	19.49
	P	0.31	1.06	(3)	9.14	43.49
	Y	0.57	1.04		5.31	25.62
World	A	22.40	25.29	(100)	0.69	3.67
	P	24.82	33.23	(100)	2.06	9.95
	Y	1.11	1.31		1.36	6.76

Note: A=Area (lakh Hectares); P= Production (lakh tones); and Y= Yield (tonnes/Ha).

Source: FAOSTAT Database, www.FAO.ORG.

The fall in price of tea was observed both in India as well as world over. The tea prices recorded in Mombasa (Kenya) in 2005 were same as that recorded about a decade ago. Tea prices in India and all over the world have not shown an increasing trend. Nevertheless immense variability in prices was observed in the past decade. Moreover the Indian prices have always remained lower than (Mombasa) Kenya prices. This phenomenon has effect on the profitability of the industry.

Efforts have been made to arrest fall in prices by way of setting up of price stabilization fund, creating a separate fund for long term development and modernization of plantation sector, increasing the allowance under Sec 33 AB of income tax Act from 20 per cent to 40 per cent; introduction of price sharing formula for equitable sharing of the sale proceeds between the bought leaf factories and small tea growers; implementation of a credit relief package; and development of IT based Information dissemination plan for the tea industry (GOI, 2004). These efforts have had a positive impact on the health of Indian tea sector. However, to make Indian tea sector more competitive, the long term strategy should be to give emphasis on quality of the product; tea product and process diversification; and also on the market diversification.

Table 2. State wise tea production in India

States	Area('000 ha)		Production('000 tones)		Yield(kg/ha)
(1)	2004 TE	% to total	2004 TE	% to total	2004 TE
Assam	231.00	(44.54)	445.25	(53.09)	1928
West Bengal	104.20	(20.09)	194.45	(23.19)	1866
Tamil Nadu	49.10	(9.47)	131.22	(15.65)	2672
Kerala	36.80	(7.09)	53.15	(6.34)	1444
Tripura	6.10	(1.18)	7.35	(0.88)	1205
Himachal Pradesh	2.10	(0.40)	1.60	(0.19)	
Karnataka	2.10	(0.40)	5.24	(0.62)	2495
Arunachal Pradesh	2.00	(0.39)	0.90	(0.11)	
Nagaland	0.50	(0.09)	0.25	(0.03)	
Manipur	0.90	(0.08)	0.25	(0.03)	
Orissa	0.05	(0.01)	0.10	(0.01)	
Sikkim	0.05	(0.01)	0.10	(0.01)	
North India	403.91	(77.87)	649.04	(77.39)	1607
South India	114.78	(22.13)	189.60	(22.61)	1652
Northeast region	240.05	(46.28)	454.09	(54.15)	1892
India	**518.68**	**(100.00)**	**838.64**	**(100.00)**	**1617**

Source: GOI (Various issues), Horticulture Production Yearbook, NHB, Ministry of Agriculture, New Delhi

Issues with small tea growers

Attempts to expand tea in non-traditional areas have not been met with much success since large plantations don't seem interested in increasing their area. Under such a situation promoting small scale tea cultivation appears to be most practical business proposition in the potential areas. These small tea estates could be located in the periphery of existing big tea plantation that enables the growers to have a tie-up arrangement with the large estates for technical know-how and sale of green leaf. This would increase tea production on one hand and also alleviate the ever swelling unemployment problem on the other. However, the small scale tea sector faces a number of problems too: lack of capital, improper knowledge about the agro-techniques of tea cultivation, inadequate input availability and problem of marketing (Das, 1998). There is a need to strengthen the technical services in order to disseminate the technical know-how of tea cultivation. A new type of production organization and ownership structure may be promoted to look after the multi-pronged problems of production, marketing and supporting services for the small holder tea production. Such an organization would be able to take care of the interest of the tea growers by making the inputs available in right quantity at right price: can make arrangements for processing of green leaves and eventually, can undertake marketing of products to enhance profits. Such a body could be drawn on the lines of Kenyan Tea Development Agency (KTDA) of Kenya or the "Tea Small Holdings Development Authority, of Sri Lanka" to cater to the needs of small tea growers.

Tea exports and its composition

In the year 2004-05 a total of 162 million kg of tea was exported, earning a foreign exchange of $ 336 million (Table 3). Tea exports could be classified into three categories based on nature of processing as black, green and others tea.In volume terms black tea accounts for 97 per cent of total tea exports and is followed by others (2 per cent) and green tea (1 per cent). The unit value realization was found to be higher in case of others group of tea ($5/Kg) followed by green tea ($3/kg) and black tea ($2/kg). The export of black tea in volume terms declined from 199 million kg in TE 1990 to 157 million kg in TE 2004.Exports in value terms also revealed similar pattern, with export earnings falling from $ 519 million to $ 316 million. The major cause of concern, however, is fall in unit value realization of tea exports from $ 3/kg in TE 1990 to $ 2/kg in TE 2004. Out of the various grades of black tea exported from the country the largest share in total tea exports is of "tea black leaf in bulk" (57 per cent) followed by "Black tea in packets >25 gm but < 1 kg" (18 per cent) and Tea black dust in bulk (11 per cent).(Singh and Singh, 1996 and Reddy et. al., 1993)

Market loyalties of Indian tea

The structural changes in direction of trade were quantified using Markov Chain analysis and the results are presented in Table 4.29. The diagonal element of the transitional probability matrix measures the probability that the export share of a country will be retained. The elements (e.g., Pij of i-th row and j-thcolourn) of the transitional probability matrix show the probability "P" that the share would shift from i-th country to j-th country. Pakistan (1.00) and others group (0.70) of countries emerged to be highly stable markets, whereas Kazakhstan (0.43) and Russia (0.33) emerged as moderately stable markets. The other major importing countries i.e., Iraq, UAE, USA, UK, Iran and Japan proved to be unstable markets for Indian tea. UK reinforces the market shares of Kazakhstan, Russia and UAE. Similarly, other group of countries also reinforces the market share of Kazakhstan and Russia. The markets of USA, UK and Iran became unstable leading to loss of market share. This could be attributed to two reasons; firstly, the production in Kenya, Sri Lanka, China and Vietnam moved to a higher plane from the mid-1990s, prompting these countries to step up their export promotion on a substantial scale.

Secondly, the Indian tea exports, faced complacency, created by the steady surge in domestic demand which, unfortunately, started sagging from around

TABLE 3: Changing composition of tea exports from India

Sl No.	Commodity		TE 1990	TE 2004	CAGR 1989-2004 TE
A.	Black tea aggregate	Q	199.06 (97.58)	157.32 (97.32)	-0.97
		V	519.11 (97.61)	315.94 (94.09)	-2.31
		UV	2.61	2.01	-1.35
i)	Black tea in packets >25 gm but < 1 kg	Q	46.80 (22.94)	28.79 (17.81)	-0.32
		V	131.85 (24.79)	58.22 (17.34)	-2.22
		UV	2.82	2.02	-1.92
ii)	Tea black leaf in bulk	Q	123.89 (60.73)	91.33 (56.50)	-3.78
		V	318.28 (59.85)	189.06 (56.30)	-4.52
		UV	2.57	2.07	-0.78
iii)	Tea black dust in bulk	Q	21.32 (10.45)	17.43 (10.78)	-0.99
		V	48.67 (9.15)	29.29 (8.72)	-0.98
		UV	2.28	1.68	0.01
B.	Green tea aggregate	Q	3.99 (1.96)	1.08 (0.67)	-7.11
		V	7.51 (1.41)	2.79 (0.83)	-4.71
		UV	1.88	2.58	2.61
C.	Others tea aggregate	Q	0.94 (0.46)	3.25 (2.01)	9.78
		V	5.23 (0.98)	17.07 (5.08)	8.58
		UV	5.54	5.26	-1.10
	Total tea	Q	203.99	161.65	-0.99
		V	531.85	335.80	-2.32
		UV	2.61	2.08	-1.35

Note: 1) Q is quantity in million kg, V is value in million $, UV is unit value in $/kg.
2) Figures in parentheses are percent to the total

1997. A number of measures have been taken by Iran and India to normalize the tea trade. Earlier Iran had banned the import of Indian tea, due to their huge domestic stocks, which has been lifted. It had reduced the tariff barriers and there was no restriction on the quantity of imports. India on the other hand is promoting the orthodox tea production in Assam, which is preferred in the Iran market. The UK has one of the highest per capita consumption for tea at 2.7 kg against 660 gm. in India. The UK consumption was estimated to grow at one per cent per annum. An equally significant aspect of the UK tea trade is its interest to re-export tea with value-addition. Thus, the UK market offers immense scope for the Indian tea industry. To regain the market share in UK, efforts need to be made for product and logo promotion and also for developing market intelligence. The promotional efforts have helped Kenya to gain a larger share (43 per cent) of UK tea market as compared to 19 per cent by India. The Indian Tea Board has identified Saudi Arabia, Syria and the UAE as three key markets in the West Asia and North Africa (WANA) region to register its logos and carry out major promotional campaigns with the aim to boost India's share of the WANA tea export market.

In Russia, there is a considerable shift noted in the consumption and buying pattern favouring orthodox tea. Sri Lanka has taken advantage of this changed scenario by increasingly establishing its foothold in that market. On the other hand, the Russian market is also price driven in the CTC segment, where cheaper teas from rivals like China and Vietnam are edging out Indian teas. The logistical advantages also favour these countries vis-à-vis India.

Table 4 Transitional probability matrix of Indian tea exports

	Kaza Khstan	Russia	UK	Iraq	UAE	USA	Iran	Paki-stan	Japan	Others
Kaza-khstan	0.431	0	0.021	0	0.411	0	1	0	0	0.048
Russia	0	0.327	0.556	1	0	0	0	0	0	0.040
UK	0	0.673	0	0	0	0	0	0	0	0.151
Iraq	0	0	0.115	0	0	0	0	0	0	0
UAE	0	0	0.307	0	0	0	0	0	0	0
USA	0.286	0	0	0	0.274	0	0	0	0	0
Iran	0.283	0	0	0	0.033	0	0	0	0	0
Pakistan	0	0	0	0	0	0	0	1	0	0.004
Japan	0	0	0	0	0	0	0	0	0	0.056
Others	0	0	0	0	0	1	0	0	1	0.701

Tea export projection to major destinations

The transitional probabilities of major importing countries were used to project the market shares of Indian "black tea leaf in bulk" for 2007 and 2009. The actual and estimated values of exports to major importing countries are presented in Table 4.30. The share of UAE, USA, Kazakhstan, Iran, Pakistan and Iraq show an increasing trend and is projected to increase further in year 2007. The exports to UK and Russia is estimated to increase however, their share in total tea exports from India is projected to fall and would be 44 per cent in 2007. The other group of countries is projected to account for a major share (22 per cent) of total tea export from India in 2007.

Thus the diversification of export market of Indian tea would boost the trade.

Comparative Advantage

The export competitiveness of tea was ascertained using the Export Performance Ratio (PER) for the selected years and shown in figure 1. During the early 1990s, the EPR recorded an increasing trend. However, during the late 1990s the EPR fell sharply, revealing erosion of comparative advantage of Indian tea. The trend was reversed through corrective measures in the form promotional efforts of the government, which needs to be sustained on a long term basis.

The projected export of total tea from India follows an increasing trend over the period and hence greater efforts are called for to increase the production of tea in the country so as to be able to meet the growing export market demand. India should also focus on quality of tea produced, so as to get premium price in the world market. Further, more convenient ways of drinking tea need to be developed through product and process development, for instance, instant tea or tea bags, which also change the style of drinking tea and thus the nature of demand.

The Nominal Protection Coefficient (NPCs) for Indian tea has been less than one for all reference years (Fig. 2), indicating that the Indian tea is price efficient. In mid 1990s NPCs showed an increasing trend revealing the erosion of export competitiveness. However, of late the NPC has started declining, revealing the gain in competitiveness. This turnaround in export performance could partly be attributed to improvement in exports to UAE, the UK and Iraq, and to some extent to CIS. Another important factor in improvement in export performance has been increase in exports to newer markets such as Pakistan, Australia, etc. Such a trend shows diversification of our export market portfolio leading to improvement in our global competitiveness in the long run. The future strategy for the tea sector should be to augment our competitive strengths in the supply chain management, value addition and marketing. The country needs to reorient our product mix, which is skewed in favour of CTC teas whereas the global demand is for orthodox tea.

Determinant of Export Demand for Tea

It appears that despite the price competitiveness of Indian tea, its export has declined

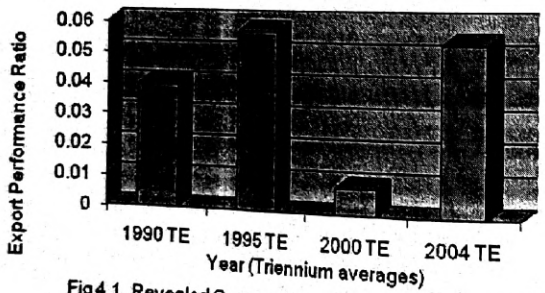


Fig 4.1. Revealed Comparative Advantage of Tea in India

Table 5. Indian tea exports to major importing nations

	United Kingdom		Russia		UAE		USA		Japan		Kazakhstan		Iran		Pakistan		Iraq		Others		Total	
	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
1995	1683	1639*	1499*	1495*	185	183*	180	180*	151	151*	35	35*	11	11*	5	5*	0	0*	571	571*	4065	
	(38.3)	(38.3)	(35.1)	(35.1)	(4.3)	(4.3)	(4.2)	(4.2)	(3.5)	(3.5)	(0.8)	(0.8)	(0.3)	(0.3)	(0.1)	(0.1)	(0.0)	(0.0)	(13.4)	(13.4)	(13.4)	
1998	1897	1932	1421	1421	696	502	219	60	197	32	163	163	178	68	134	7	188	188	2512	731	7618	
	(25.0)	(25.6)	(18.7)	(33.3)	(9.2)	(11.8)	(2.9)	(1.4)	(2.6)	(0.8)	(2.1)	(3.8)	(2.3)	(1.6)	(1.8)	(0.2)	(2.5)	(4.4)	(33.0)	(17.2)		
2001	1334	1334	1810	1810	583	583	257	237	141	141	694	694	266	266	144	144	733	218	2376	2178	8518	
	(16.0)	(17.5)	(21.8)	(21.8)	(7.0)	(7.7)	(2.8)	(3.1)	(1.7)	(1.9)	(8.3)	(9.1)	(3.2)	(3.5)	(1.7)	(1.9)	(8.8)	(2.9)	(28.6)	(28.6)	(28.6)	
2004	1710	1575	2269	2164	757	410	338	358	254	133	946	946	499	381	367	153	795	154	2303	2044	10188	
	(16.8)	(18.9)	(27.2)	(26.0)	(7.4)	(4.9)	(3.5)	(4.3)	(2.5)	(1.6)	(9.3)	(11.4)	(4.3)	(4.6)	(3.6)	(1.8)	(7.8)	(1.8)	(22.6)	(24.6)		
2007		1873		2582		526		478		129		1334		507		376		197		2227		
		(18.4)		(25.3)		(5.2)		(4.7)		(1.3)		(12.8)		(5.0)		(3.7)				(21.8)		
2010		2072		2174		506		517		125		1450		535		386		216		2469		
		(20.3)		(21.3)		(5.0)		(5.1)		(1.2)		(14.0)		(5.2)		(3.8)		(2.1)		(21.5)		

Note: A and "*" are actual values; P is projected value.

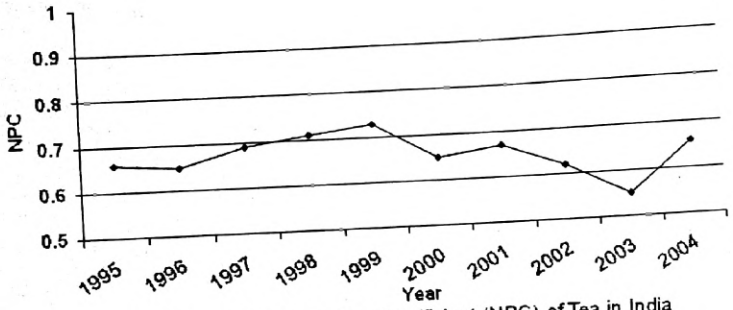


Fig 4.2. Nominal Protection Coefficient (NPC) of Tea in India

over the years. Therefore, to ascertain the factors responsible for decline in India' tea exports, export Demand function has been estimated .The five determinants of export demand ,namely ,exports prices (Xpr) market size (Ttea) , exchange rate (ERR) , coffee market in the international market (coffee_PRI),and production of tea in the world other than that in India(TEA_q)together explain 59 percent of the total variation in the exports of tea from India (Table 6). The exchange rate and market size (world) and coffee price in international market have emerged as significant and strong determinants for tea exports. The estimates for world tea market shows that for one per cent increase in the world tea trade, exports demand for Indian tea would increase by around 1.4 per cent. The coffee price, in terms of unit value of export, has a positive and significant bearing on the export demand of tea. This establishes the substitutability nature of the two products. The recent fall in demand for tea both in the domestic and international markets is attributed to consumer preference for soft drinks, which means that the whole of beverages cold be viewed as one , with each of the commodities vying for their share. Massive campaign about the health and fitness benefits of tea has to be undertaken o a continuous basis so as to improve its demand.

The increase in the production of tea in other parts of the would have negative impact on the export of tea from India. The country can avert the effect, of increase in production in other parts of the world would have negative impact on the export of tea from India, by way of product diversification emphasizing on quality, and widespread development of logo and brand name of Indian tea. International export price of Indian tea has positive but insignificant impact o.n export demand of tea. This is because tea is a popular drink whose demand is relatively insensitive to price.

Suggestions and Policy Implications

To make the Indian tea sector more robust and resilient the flowing steps need to be taken up:

Concerted efforts have to be made by different stakeholders to increase the productivity of tea plantations. The extension services should be strengthened to disseminate the technical know-how to the small tea growers located in remote areas.A new type of production organization and ownership structure may be promoted to look after the multi-pronged problems of production, marketing and supporting services for the small holder tea production > such an organization would be able to take care of the interests of the tea growers by making the inputs available in right time at right price..

The country can get back its place among our traditional tea markets of Russia and other CIS nations by diversification of tea products, quality up gradation and aggressive brand and logo campaign. These efforts would also help in realization of better prices thus improving our competitiveness and profitability of tea industry.

In the short terms, aggressive generic promotion for tea in the domestic market is very much needed. A slight change in the promotion theme, from health to fitness would be more appealing. The focus at first should be on those states where per capita tea consumption is very low.

Market diversification away from traditional markets offers great scope to boost Indian tea exports.

REFRENCES

Bandyopadhyay. (1982). Economic analysis of Some Critical problems of Tea Export of India. Indian *Journal of Agricultural Economics*, Vol.37 (3): 306-310.

Batra, A. And Zeba Khan (2005). Revealed Comparative Advantage: An Analysis for India and China. Working paper. 1678. Indian Council for Research on International Economics Relations, New Delhi.

Chand, R. (1999). Liberalization of Agricultural Trade and net Social Welfare: A study of Selected Crops. www.epw.in/34-52/ras.html.c7p[EPW.1999]. ii

Chand, R. and S.C. Tiwari (1991). Growth and Instability of Indian Exports of Agricultural Commodities, Indian Journal of Agricultural Economics, 46(2): 159-165.

Cuddy, J.D.A. and P.A. Della Valle .(1978). Measuring the Instability in Time Series Data. *Oxford Bulletin of Economics and Statistics*. Vol.40 (1).

Deshpande, R. S. (2003). Liberalization, Domestic Price Policy and Agricultural Growth .*Indian Journal of Agricultural Economics*, Vol.58 (3):636-648.

Gill, Sucha Singh and Jaswinder Singh Brar (1996). India's Agricultural Exports: Performance and Some Policy Issues. *Indian Journal of Agricultural Economics*, Vol. 31(32): 2167-2177.

Government of India, EXIM Report. Agri export advantage, various issues, Ministry of Commerce, Various issues, DGCI & S, Kolkata.

Government of India, Foreign trade Statistics of *India – principal Commodities and Countries*, Various Issues, DGCI & S, Kolkata.

Reddy, B.V.Chinnappa., T.R. Keshava Reddy, J. B. Venkatram, A.Chandran. and T. N. Prakash (1993). "Production and Exports of Indian Tea and Coffee" An Analysis of Growth and Instability .*Indian Journal of Agricultural Marketing*, Vol.7 (1):32-39.

Singh, N.P. and R.P.Singh (2003). Market Avenues for Agriculture Under Globalization and Liberalization, *Indian Journal of Agricultural Economics*, Vol.17 (1):16-26.

Journal of Natural Resource and Development 4(2):103-107, 2009

COMMUNICATION BEHAVIOUR OF SOCIAL FORESTRY FARMERS OF DISTRICT JAUNPUR

Tej Pratap Singh and N. K. Mishra
Dept of Agricultural Extension, Tilakdhari P.G. College, Jaunpur (U.P.)

ABSTRACT

Big category of farmers was more social and active to participate in solving the local problems. The farmers got information through the extension methods particularly the localite sources. It was observed in field during the data collection that majority of respondents had transistor sets and few respondents had television sets. Majority of villages were electrified but electricity supply was negligible. Therefore, majority of respondents were dependent on Newspaper and other printed materials. Folders and leaflets were supplied by the input dealers. Big category farmers had high level of risk preference and remaining respondents had medium level of risk preference. This is fact that farmers are basically poor therefore, principally unable to bear the risk as they are hardly in position to spend extra money for scientific inputs.

Key Words : *Social Participation, extension contact, adoption*

The concept of social forestry is a part of cultural heritage of tree farming of local people and existed in ancient time also. The demand of fuel wood, fodder, timber and food for ever growing population has resulted in the clearance of trees even from the community lands. Fruits have special significance to human beings as a protective food, the well established and properly maintained orchard alone or grown with suitable tree inter-crops can offer better yield and income per unit area as compared with cereal crops some fruits are hardly and are best sited to wasteland, arid and semi-arid regions for getting higher income with minimum inputs. Fruits plants also provide aesthetic beauty, purify air and decrease pollution.

Communication behaviour of an individual affects the knowledge and adoption of social forestry programme. This variable was taken into account to findout the common sources of information available with them and utilised by them, which were helpful in acceptance and adoption of social forestry programme. This variable includes two types of sources of information which were Extension Contact and Mass-Media Exposure.

MATERIALS AND METHODS

Ex-post-facto research design was used for the study. Multistage sampling technique was used for the selection of respondents. The study was conducted in 5 each randomly selected villages of two C.D. blocks of Jaunpur district of Uttar Pradesh. The respondents were selected on the basis of stratified random sampling method, where 60, 60 and 80 respondents were randomly selected from the three strata big, medium and small as per possession of land of farmers on the basis of government classification. Therefore a total of 200 respondents were selected. The study was centered to 12 independent and 3 dependent variables. The independent variables were age, caste, education, occupation, social participation, social status, economic status, socio-economic status, extension contact, mass media exposure, communication behaviour and risk preference. The dependent variables were extent of adoption, cost-benefit analysis and constraints in adoption. The measurement of variables was made with the help of developed scales and indexes specially developed for

the study. The data was collected personally by the scholar with the help of pretested structured interview schedule after establishing rapport with the respondents. The collected data was classified, tabulated and processed with the help of percentage.

RESULTS AND DISCUSSION

1 Social Participation

Social participation refers to the activities of individual in the society and its organization. The state of social participation reveals the association responsibility and concern of individual towards the society welfare. The social participation of individual also indicates high state of interpretation, understanding and acceptance of knowledge. The Table 1 shows the status of social participation among the respondent.

Table 1 indicates that 133 (66.5 per cent) respondents had no association with any social organization. There were 67 (33.5 per cent) respondents who had the membership of local organization. In case of small category of farmers, 67 respondents had no membership of any social organization, however remaining 13 respondents had the membership of social organization. In case of medium and big categories of farmers, 44 and 22 respondents had no association with any social organization, respectively, whereas 16 and 38 respondents had the membership of social organization, respectively. The table shows that the big category of respondents was more social and active to participate in solving the local problems followed by medium and small categories of respondents. (Hossain and Rakkaibu, 1993 and Singh and Singh, 1968).

2 Extension contact

Although the modern mass media has its great impact among the masses also can not give the desired results in acceptance and adoption of any innovation where majority of population is illiterate, traditionalist and shy in nature. Therefore, the role of extension is very important in Indian situation as the farmers rely more and dependent on the extension contact. The extension contact includes both localites and cosmopolite sources of information. The extension contact had taken into account of the sources of information through the extension personal, research scientist, social workers, neighbors, friends, relatives and so on. These individual uses the various extension methods and approaches to pass on the information. The bases of obtained scores, this variable has been categorised as low, medium and high extension contact to find out the relation with adoption of social forestry programme.

Table 1 Distribution of respondents according to their social participation

Sl. No.	Social Participation	Frequency of respondents			
		Big n=60	Medium n=60	Small n=80	Overall N=200
1.	Not the member of any organization	22 (11.0)	44 (22.0)	67 (33.5)	133 (66.5)
2.	Member of organization	38 (19.0)	16 (08.0)	13 (06.5)	67 (33.5)

Figures in parentheses indicate percentage

Table 2 reveals that out of overall 200 respondents there were only 13 (06.5 per cent) respondents who had high level of extension contact whereas majority 119 (59.5 per cent) respondents had low level of extension contact and remaining 68 (34.0 per cent) respondents had medium level of extension contact. The similar trends were also found with all the three categories of respondents separately. This shows that the farmers had been exposed a little through the most powerful methods and approaches/ sources of information. Whatever the farmers had sources of information through the extension methods and approaches were available with farmers were only the localite sources . It is reported that negligible efforts have been made to create awareness among the farmers through various cosmopolite methods and approaches of extension. (Jha and Pandey, 1995).

Table 2 Distribution of respondents according to their extent of extension contact

Sl. No.	Extensions contact	Frequency of respondents			
		Big n=60	Medium n=60	Small n=80	Overall N=200
1.	Low	27 (13.5)	34 (17.0)	58 (29.0)	119 (59.5)
2.	Medium	26 (13.0)	23 (12.5)	19 (09.5)	68 (34.0)
3.	High	07 (03.5)	03 (01.5)	03 (01.5)	13 (06.5)

3. Mass-Media Exposure

In view of diversities in language, culture, agro-climatic situations etc. of India, the sources of information through mass media are the only possibility to serve more than 100 million population of the country. Today radio and television have the network in all over the country and serve the farmers at their farm and home and even at their bedrooms. Specially of wide coverage, speed and timeliness has increased the dependency of Indian farmers on mass media. Here in present study, the variable includes radio, television, newspaper, magazine and like among the respondents. This variable was divided in three categories low, medium and high on the base of utilization of mass media as a source of information among the respondents.

Table 3 reflects that overall majority of 97 (48.5 percent) respondents had medium level of mass media exposure followed by 64 (32.0 per cent) and 39 (19.5 per cent) respondents had low and high level of mass media exposure, respectively. The similar trends were also found among all the three categories of respondents separately. It was observed in field during the data collection that majority of respondents had transistor sets and few respondents had television sets. However, out of 10 selected villages 8 villages were electrified but electricity supply was negligible therefore, majority of respondents were dependent on Newspaper and other printed materials- folders and leaflets supplied by the input dealers.

Table 3 Distribution of respondents according to their mass media exposure

Sl. No.	Mass-media exposure	Frequency of respondents			
		Big n=60	Medium n=60	Small n=80	Overall N=200
1.	Low	14 (07.0)	19 (09.5)	31 (15.5)	64 (32.0)
2.	Medium	29 (14.5)	25 (12.5)	43 (21.5)	97 (48.5)
3.	High	17 (08.5)	16 (08.0)	06 (03.0)	39 (19.5)

4. Communication Behaviour

State of communication behaviour of the respondents is measured by total of obtained score of state extension contact and mass-media exposure. The Table 4 presents the distribution of respondents according to their state of communication behaviour.

Table 4 depicts that 93 (46.5 per cent) respondents had low state of communication behaviour followed by 82 (41.0 per cent) and 25 (12.5 per cent) respondents had high and medium state of communication behavior, respectively. In case of small category of farmers, 45 (22.5 per cent) respondents had low state of communication behavior followed by 31 (15.5 per cent) and 04 (02.0 per cent) respondents had medium and high state of communication behavior, respectively. Identical trend was also found in case of medium category of respondents, however medium state of communication behavior was found among majority of big category respondents followed by low and high state of communication behavior . This proves that they are under privileged society of the country who have little access to the media and the extension agents. Whatsoever information they got were only the localite sources and the extension agent of voluntary organizations and inputs dealers.

Table 4 Distribution of respondents according to their communication behavior

Sl. No.	Communication Behaviour	Frequency of respondents			
		Big n=60	Medium n=60	Small n=80	Overall N=200
1.	Low	21 (10.5)	27 (13.5)	45 (22.5)	93 (46.5)
2.	Medium	27 (13.5)	24 (12.0)	31 (15.5)	82 (41.0)
3.	High	12 (06.0)	09 (04.5)	04 (02.0)	25 (12.5)

Table 5 Distribution of respondents according to their state of risk preference

Sl. No.	State of risk preference	Frequency of respondents			
		Big n=60	Medium n=60	Small n=80	Overall N=200
1.	Low	00	09 (04.5)	24 (12.0)	33 (16.5)
2.	Medium	22 (11.0)	33 (16.5)	53 (26.5)	108 (54.0)
3.	High	38 (19.0)	18 (09.0)	03 (01.5)	59 (29.5)

5. Risk Preference

Adoption of fast growing varieties and its recommended social forestry practices requires extra amount of expenditure as compared to local varieties. Many farmer who are security oriented, are not willing to take any risk. The risk bearing with their willingness has the importance in acceptance and adoption of new technology. On the basis of score obtained by the respondents, the variable was divided in three categories as low, medium and high risk preference. The Table 5 shows the distribution of respondents according to their risk preference.

It is clear from table 5 that 108 (54.0 per cent) respondents had medium level of risk preference followed by 59 (29.5 per cent) and 33 (16.5 per cent) respondents who had high and low level of risk preference, respectively. Similar trends were found in case of small and medium categories of respondents separately. However, in case of big category of farmers, majority of respondents had high level of risk preference and remaining respondents had medium level of risk preference. This is fact that farmers are basically poor therefore principally unable to bear the risk as they are hardly in position to spend extra money for scientific inputs. However, it is encouraging that majority of 83.5 per cent respondents had reported high and medium level of risk preference because of minimum risk in social forestry practices.

REFERENCES

Hossain, M.M. and Rakkibu, M.G. (1993). Resource availability, training and tree planting on private land : A study in a Bangladesh village, *Chittagong Univ. Studies Sc.*, **17(2)** : 5-13.

Jha, K.K. and Pandey, K.N. (1995). A study of factors associated with the attitude and participation of farmers in social forestry programme in Varanasi District, (U.P.), *M.Sc.(Ag.) Thesis, I.A.S., BHU* (Unpublished with membership of one organisation only.

Singh, R.P. and Singh, K.N. (1968). Attitude of farm people towards chemical fertilizers, *Ind. Jl. of Ext. Edn.*, **IV** : 53.

Journal of Natural Resource and Development 4(1): 108-113, 2009

PROPERTIES AND FUNCTIONS OF BIOACTIVE COMPONENTS OF BOVINE MILK

Jagdish Prasad and Deepak S. Bhadoria
Department of Animal Husbandry and Dairying
Sam Higginbottom Institute of Agriculture, Technology & Sciences

Bioactive components are proteins that have biochemical and physiological functions beyond basic nutritional value. Bioactive protein not only helps to improve muscles but also plays a crucial part in the process of healing of the entire body.

Proteins are fundamental to all forms of life. Proteins not only make up the structure of human bodies but also make up antibodies for immune response and energy source equivalent to carbohydrates. Proteins play an important role in every metabolic, physiologic and structural process required for life. The quantity of protein that a person required in a day is approximately 60 – 70g per day or 0.8 – 1.3g per kilogram of body weight.

Whey proteins that constitute 20 per cent of milk protein especially are of high nutritional quality, containing 51 per cent essential amino acids, compared to 45 per cent in casein. Whey protein also contains immune factors such as immunoglobulins (Ig), lactoferrin, alpha-lactalbumin and beta-lactoglobulin. All these factors are present in the colostrums that pass from mother to baby during lactation. Whey proteins act as anti-bodies in order to protect the body from potentially pathogenic microorganisms, such as bacteria and virus. It was as effective as colostrums in protecting newborn calves from disease. The Protein Efficiency Ratio (PER) (3.1), Biological Value (BV) (91) and Net Protein Utilization (NPU) (82) of milk proteins are very close to that of egg proteins (3.8, 100 and 94, respectively). Lactalbumin is superior to casein having BV, NPU and PER 108, 92 and 3.6, respectively. The corresponding values of casein are 77, 76 and 2.5, respectively. Only 14.5g of lactalbumin or 28.5g milk proteins is sufficient to meet the daily requirement of essential amino acids for adult humans, opposed to 50-60g proteins required from mixed vegetarian diet (**Kansal, 1992a**). Whey proteins also play a vital role in the resistance against intestinal bacterial infections, especially *E. coli* which can lead to malabsorption, chronic fatigue, digestive disorder and overall reduction in immune system function.

DIGESTIBILITY VALUE OF MILK PROTEINS

Kansal (1992a) reported that the digestibility of milk proteins is rated higher (98 %) than that of plant proteins (74-78 %). Because of their high BV, the milk proteins are useful in the diet of patients suffering from gall bladder and liver diseases. Patients with impaired kidney functions rely on protein with high BV for relieving strain on the excretory function of the kidney. The milk proteins are also used in slimming diets.

Because milk proteins contain a surplus of certain essential amino acids (lysine and threonine), which can raise the BV of vegetable proteins. Milk proteins can be added to cereal based products to increase their lysine and threonine contents. Whey proteins have even better supplementary value. A mixture of whey protein, wheat, rice or maize has PER value even greater than that of whey proteins. Whey obtained as a by-product in cheese manufacture has thus great potential for incorporation in cereal based products (**Kansal, 1992a**).

Milk occupies a special position among foods in human being as an animal food that has a vegetarian connotation. Also milk plays an important role in meeting the requirements of many essential nutrients (**Table 1**). Foods containing bioactive components

are functional foods as it contains varieties of bioactive components. Milk is valued as an important source of many of the nutrients essential for the proper development and maintenance of the human body. Whole cow's milk is a high-fat fluid, designed by nature to turn a 27- 30 kg calf into a 135 – 275 kg cow in one year. FAO and WHO recognise that milk is an important commodity that contributes to household nutrition and health, and can also provide an income. Therefore, approaches for enhancing the availability of safe milk and dairy products are important for the continued improvement of household nutrition and health. Milk contains serum cholesterol lowering factors. Lactic acid produced from milk sugar, lactose, inhibits the growth of proteolytic and putrefying bacteria in the large intestine.

Lactoferrin was first isolated by **Sorensen and Sorensen** from bovine milk in 1939. In 1960 it was concurrently determined to be the main iron binding protein in human milk by three independent laboratories of **Groves (1960), Johanson (1960)** and **Montreuil *et al.*, (1960)**.

Lactoferrin's capability of binding iron is two times higher than that of transferrin, which can serve in some cases as donor of Fe^{3+} ions for Lactoferrin. Two ferric ions can be bound by one Lactoferrin molecule. One carbonate ion is always bound by Lactoferrin concurrently with each ferric ion (**Aisen and Liebman, 1972**). Although this bond is very strong and can resist pH values of as low as 4, its saturation does not exceed 10 per cent in total (**Mazurier and Spik, 1980**). There are three forms of Lactoferrin according to its iron saturation: apolactoferrin (iron free), monoferric form (one ferric ion) and hololactoferrin (binds two Fe^{3+} ions). The tertiary structure in hololactoferrin and apolactoferrin is different (**Jameson *et al.*, 1998**).

Table 1: Nutrient Content in Bovine Milk (per 100g)

	Cow	Buffalo
Protein (g)	3.4	3.8
Fat (g)	3.7	7.0
Lactose (g)	4.6	5.1
Calcium (mg)	120	210
Vitamin C (mg)	1.8	2.2
Vitamin A (IU)	126	178
Vitamin E (µg)	110	180
Thiamine (µg)	42	90
Riboflavin (µg)	172	157
Pyridoxine (µg)	48	50
Folic acid (µg)	5.0	6.0
Vitamin B_{12}	0.45	0.42

Biological functions of Lactoferrin

1. *Lactoferrin and iron metabolism*

Although the influence of lactoferrin on iron distribution in an organism is implied by its resemblance to transferrin, it has thus far not been unequivocally proven that lactoferrin plays an important role in iron transport. This may be due to the fact that lactoferrin plasma concentrations are very low under normal conditions. On the other hand, the lactoferrin level increases when inflammation occurs. **Brock (2002)** suggested that in such an environment iron exchange from transferrin is easier due to the lower pH suggesting that lactoferrin may contribute to local iron accumulation at sites of inflammation.

2. *Antimicrobial activity*

Lactoferrin is considered to be a part of the innate immune system. At the same time, lactoferrin also takes part in specific immune reactions (**Legrand *et al.*, 2005**). Due to its strategic position on the mucosal surface lactoferrin represents one of the first defense systems against microbial agents invading the organism mostly via mucosal tissues. Lactoferrin affects the growth and proliferation of a variety of infectious agents including both Gram-positive and negative bacteria, viruses, protozoa, or fungi (**Kirkpatrick *et al.*, 1971**).

3. *Antibacterial activity*

Its ability to bind free iron, which is one of the elements essential for the growth of bacteria, is responsible for the bacteriostatic effect of Lactoferrin (**Arnold *et al.*, 1980**). According to **Brock (1980)**, lack of iron inhibits the growth of iron-dependent bacteria such as *E. coli*. In contrast, lactoferrin may serve as iron donor, and in this manner support the growth of some bacteria with lower iron demands such as *Lactobacillus* sp. or *Bifidobacterium* sp., generally considered as beneficial (**Petschow *et al.*, 1999; Sherman *et al.*, 2004**).

In vitro lactoferrin is able to prevent *Pseudomonas aeruginosa* biofilm formation. The lack of iron in the environment forces bacteria to move. Therefore, they cannot adhere to surfaces (**Singh *et al.*, 2002**).

The proteolytic activity of lactoferrin is considered to inhibit the growth of some bacteria such as *Shigella flexineri* or enterpathogenic *E. coli* through degrading proteins necessary for colonization. However, this can be disabled by serine protease inhibitors (**Ward *et al.*, 2005**).

Lactoperoxidase is an enzyme that is naturally present in milk. One of its unique biological functions is a bacteriostatic effect in the presence of hydrogen peroxide and thiocyanate. Both of these substances are naturally present in milk in varying concentrations. The method of activating the LP-s in milk is to add about 10 ppm (parts per million) of thiocyanate (preferably in powder form) to raw milk to increase overall level to 15 ppm (around 5 ppm is naturally present). Solution is thoroughly mixed for 30 seconds and then an equimolar amount (8.5 ppm) of hydrogen peroxide is added (generally in the form of a granulated sodium carbonate peroxyhydrate). Activation of the lactoperoxidase has a bacteriostatic effect on the raw milk and effectively extends the shelf life of raw milk for 7-8 hours under ambient temperatures of around 30°C or longer at lower temperatures. This allow adequate time for milk to be transported from the collection point to a processing centre without refrigeration.

IMMUNOLOGICAL ASPECTS OF BOVINE MILK PROTEINS

Immunoglobulins are present in colostrums of all lactating species. Mainly bovine immunoglobulin use against diarrhea, oral pathogens (*Streptococcus mutans*, *Candida albicans*), gastric pathogen (*Helicobacter pylori*) and Enteropathogenic *E. coli* infections in children.

Lactoferrin is an iron binding glycoprotein that occurs in cow milk at a level of 0.2 mg/ml. in comparison to that mother's milk contains huge amounts of Lactoferrin (0.1-0.2g/ 100 ml). Lactoferrin plays an important role in the resistance against intestinal infection, particularly *Escherichia coli*. Lactoferrin has both bacteriostatic and bactericidal properties. The bacteriostatic effect of lactoferrin is due to its iron binding ability making iron unavailable for iron requiring bacteria.

Enzymes like lactoperoxidase, xanthin oxidase and lysozyme are also involved in the milk immune system. Lysozyme has a direct effect by breaking down the cell wall of gram-positive bacteria. Lactoperoxidase-thio-cyanate-H_2O_2 system is an antibacterial system. Lactoperoxidase and thiocyanate are found in milk and other tissue secretions, and H_2O_2 is produced by lactic acid bacteria or by the action of xanthin oxidase. Thiocyanate is oxidized by H_2O_2 and

lactoperoxidase to an intermediate product that destroys the microorganisms (Kansal, 1992a).

Bioactive peptides

Bioactive peptides are food derived peptides that have physiological effect in the body in addition to their nutritional value. Fiat *et al.* (1993) reported that many milk-derived peptides possess functional properties. Several peptides with opium like (sleep inducing) activity have been extracted from the degradation products of milk proteins. These include ß-casomorphins (from ß-casein), exorphin (from µ-casein), ß-lactostensin (from lactoglobulin) and serorphin (from serum albumin). These opium like peptides have been shown to prolong gastrointestinal transit time exerting anti-diarrhoeal effect.

Several immunostimulatory peptides have been identified from both bovine and human casein and whey proteins. Casecidin, a chymosin digest of casein *in vitro*, inhibits *Sarcina*, *Bacillus subtitis*, *Diplococcus pneumoniae* and *Streptococcus pyrogenes*. Iracidin, an μ_{s1}-casein fragment has both therapeutic and prophylatic effect. Lactoferricin, an acid-pepsin digestion product of lactoferrin, has stronger bactericidal activity compared to the native molecule (Lahov and Regelson, 1996).

Growth Factors

Growth factors play an important role in growth promoting or growth inhibitory activities. The main growth factors in bovine milk are insulin like growth factor, beta cellulin, epidermal growth factors, fibroblast growth factors, transforming growth factor and platelet-drived growth factor. IGF stimulate proliferation of many cell types and regulate some metabolic functions like glucose uptake and synthesis of glycogen. Epidermal growth factors and beta cellulin stimulate the proliferation of epidermal, epithelial and embryonic cells as they inhibit the secretion of gastric acid and promote wound healing and bone resumption.

When report came that milk contains IGF-1, the possibility of its involvement in causation of cancer was feared. However, the involvement of IGF-1 that could be present in bovine milk, in cancer is an extrapolation of the fact that the elevated level of this hormone is found in the bodies of cancer patients. The high level of IGF-1 is nothing but an indication or a symptom of cancer. In fact IGF-1 is a normal growth factor found in everybody secretions. Implication of milk IGF-1 in cancer has no basis. Emerging scientific findings, however, indicate that milk contains several components such as CLA, sphinogomylein, butyric acid, myristic acid, vitamin A, ß-carotene, which have potential to inhibit the development of cancer (Parodi, 1996). Indeed, milk fat is the richest natural dietary source of CLA.

Although, some researchers have suggested that milk proteins, particularly bovine serum albumin, trigger an autoimmune response that destroys pancreas beta cells in genetically susceptible children causing Type 1 or insulin-dependent diabetes (IDDM), scientific evidence to date fails to support a causal association between cow's milk proteins and IDDM. When the feeding practices of over 250 children having IDDM were compared with those of non-diabetic children, no association was found between early introduction of cow milk during infancy and IDDM (Bodington *et al.* 1994).

CONCLUSIONS

Constantly increasing insulinemia may downregulate the insulin receptor and hence lead to insulin resistance (Rizza *et al.* 1985), which in turn is the primary metabolic defect underlying the metabolic syndrome and may be a driving force in Obesity (Thomas *et al.* 2007). It should also be mentioned that a chronic state of Hyperinsulinemia may set a hormonal cascade that ultimately results in Cancer, Acne and Juvenile Myopia, among other diseases (Cordain *et al.* 2003). Indeed, a high bovine milk diet has been shown to cause insulin resistance in boys (Hoppe 2005). Moreover, dairy intake is strongly associated with a higher incidence of Acne and moderately associated with Prostate Cancer (Kurahashi *et al.* 2008).

Cow's milk appears to be involved in certain autoimmune diseases (AD). There is molecular mimicry between Bovine Serum Albumin and Human Collagen Type 1, which has implications for Rheumatoid Arthritis (Cordain *et al.* 2000). Bovine milk is also implicated (or appears to have adverse effects) in other auto-immune diseases, such as Crohn's disease (Van den 2001), IgA nephropathy and even Celiac Disease (Fornasieri *et al.* 1988).

In addition to proteins, fats, lactose, vitamins and minerals, Milk contains various growth-stimulating steroid and peptide hormone and also catalysts, transporters and stabilizers that ensure their maximum bioactivity. Cow's milk, as well as human milk (and presumably milk from all mammals) contains insulin (Ballard *et al.* 1982), and bovine insulin – BI {which differs from human insulin by three amino acids (Vaarala, 2006)} survives pasteurization, because immunity to this hormone is common in children who consume cow's milk or who have been exposed to infant formulas containing cow's milk

REFERENCES

Aisen, P. and Liebman, A., 1972., Lactoferrin and transferring: a comparative study. *Biochemica et Biophysica Acta, 257*: 314-323.

Arnold, R. R., Brewer, M. and Gauthier, J. J., 1980., Bactericidal activity of human Lactoferrin: *sensitivity of a variety of microorganisms. Infection and Immunity, 28*: 893-898.

Ballard, F. J., Nield, M. K., Francis, G. L., Dahlenburg, G. W. and Wallace, J. C., 1982., The relationship between the insulin content and inhibitory effects of bovine colostrum on protein breakdown in cultured cells. *J. Cell Physiol. 110(3)*: 249-254.

Bodington, M. J., McNally, P. G. and Burden, A. C., 1994., Cow's milk and type I childhood diabetes: no increase in risk. *Diabetic Med. 11*:163.

Brock, 2002., The physiology of lactoferrin. *Biochemistry and cell biology. 80*: 1-6.

Brock, J. H., 1980., Lactoferrin in human milk: its role in iron absorption and protection against enteric infection in the newborn infant. *Archives of Disease in Childhood. 55*:417- 421.

Cordain, L., Eades, M. R. and Eades, M. D., 2003., Hyperinsulinemic diseases of civilization: *more than just syndrome X. Comp Biochem Physiol Part A. 136*: 95-112.

Cordain, L., Toohey, L., Smith, M. J. and Hickey, M. S., 2000., Modulation of immune function by dietary lectins in rheumatoid arthritis. *Brit J Nutr. 83*: 207-217.

Fiat, A. M., Migliore-Samour, D., Jolles, P., Drouet, L., Bal Dit Soitier, C. and Caen, J., 1993., Biologically active peptides from milk proteins with emphasis on two examples concerning immunomodulating activities. *J. Dairy Sci. 76*: 301-310.

Fornasieri, A., Sinico, R. A., Maldifassi, P., Paterna, L., Benuzzi, S., Colasanti, G. and D'Amico, G., 1988., Food antigens, *IgA-immune complexes and IgA mesangial nephropathy. Nephrol Dial Transplant. 3(6)*: 738-743.

Groves, M. L., 1960., The isolation of a red protein from milk. *Journal of the American Chemical Society. 82*: 3345-3350.

Hoppe, C., 2005., High intakes of milk, but not meat increase s-insulin and insulin resistance in 8-year-old boy. *Eur J Clin Nutr. 59(3)*: 393-398.

Jameson, G. B., Anderson, B. F., Norriss, G. E., Thomas, D. H. and Baker, E. N., 1998., Structure of human apolactoferrin at 2.0 A resolution. Refinement and analysis of ligand-induced conformational change. Acta Crystallographica. Section D, *Biological Crystallography. 54*, 1319-1335.

Johanson, B., 1960., Isolation of an iron containing red protein from human milk. *Acta Chemica Scandinavica, 14*: 510-512.

Kansal, V. K., 1992a, Essentialities of milk proteins in human diet. *Indian Dairyman, 44*: 328-331.

Kirkpatrick, C. H., Green, I., Rich R. R. and Schade, A. L., 1971., Inhibition of growth of Candida albicans by iron unsaturated Lactoferrin: *relation to host-defense mechanisms in chronic mucocutaneous candidiasis. The journal of Infectious Diseases, 124*: 539-544.

Kurahashi, N., Inoue, M. and Iwasaki, M., 2008., Dairy product, saturated fatty acid, and calcium intake and prostate cancer in a prospective cohort of Japanese men. *Cancer Epidemiol Biomarkers Prev. 17(4)*: 930-937.

Lahov, E. and Regelson, W., 1996., Antibacterial and immunostimulating casein-derived substances from milk: *caseicidin, isracidinpeptides. Food Chem. Toxicol., 34*: 131-145.

Legrand, D., Elass, E., Carpentier, M. and Mazurier, J., 2005., Lactoferrin: a modulator of immune and inflammatory responses. *Cellular and Molecular Life Sciences, 62*: 2549-2559.

Mazurier, J. and Spik, G., 1980., Comparative study of the iron-binding properties of human transferrins. I. Complete and sequential iron saturation and desaturation of the lactotransferrin. *Biochimica et Biophysica Acta, 629*: 399-408.

Montreuil, J., Tonnelat, J. and Mullet, S., 1960., Preparation and properties of lactosiderophilin (lactotransferrin) of human milk. *Biochimica et Biophysica Acta 45*: 413 -421.

Orsi, N., 2004., The antimicrobial activity of Lactoferrin: current status and perspectives. *Biometals. 17*: 189-196.

Parody, P. W., 1996., Milk fat components: *possible chemo preventive agents for cancer and other diseases. Aust. J. Dairy Technol. 51*: 24-32.

Petschow, B. W., Talbott, R. D. and Batema R. P., 1999., Ability of Lactoferrin to promote the growth of *Bifidobacterium sp. in vitro* is independent of receptor binding capacity and iron saturation level. *Journal of Medical Microbiology, 48*: 541-549.

Rizza, R. A., Mandarino, L. J., Genest, J., Baker, B. A. and Gerich, J. E., 1985., Production of insulin resistance by hyperinsulinaemia in man. *Diabetologia, 28(2)*: 70-75.

Sherman, M. P., Bennett, S. H., Hwang F. F. and Yu, C., 2004., Neonatal small bowel epithelia: enhancing anti-bacterial defense with lactoferrin and *Lactobacillus* GG. *Biometals, 17*: 285-289.

Singh, P. K., Parsek, M. R., Greenberg, E. P. and Welsh, M. J., 2002., A component of innate immunity prevents bacterial biofilm development. *Nature. 417*: 552-555.

Sorensen, M. and Sorensen, S. P. L., 1939., The proteins in whey. *Comptes-rendus des Travaux du Laboratoire Carlsberg. 23*: 55-99.

Thomas, D. E., Elliott, E. J. and Baur, L., 2007., Low glycaemic index or low glycaemic load diets for overweight and obesity. *Cochrane Database Syst Rev. 18(3)*: CD005105.

Van den, Bogaerde., 2001., Immune sensitization to food, yeast and bacteria in Crohn's disease. *Aliment Pharmacol Ther. 15(10)*: 1647-1653.

Varrala, O., 2006., Is it dietary insulin? *Ann N Y Acad Sci. 1709*: 350-359.

Ward, P. P., Paz, E. and Conneely, O. M., 2005., Multifunctional roles of Lactoferrin: *a critical overview. Cellular and Molecular Life Sciences. 62*: 2540-2548.