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CONTENT

AF-I

Veterinary Science, Animal Husbandry & Fisheries

1. **Calving interval as influenced by certain genetic and non-genetic factors in Brownswiss crosses with various levels of inheritance**
   R. P. Singh, Neeraj, J. Prasad **1 - 4**

2. **Factors affecting service period in Brownswiss crosses with various levels of inheritance**
   R. P. Singh, Neeraj, J. Prasad **5 - 8**

AF-II

Engineering & Technology, Dairy Technology & Food Technology

3. **Organoleptic Study of Different Levels of Sugar on Sweet Cottage Cheese by Direct Acidification Technique**
   George Prince and Ramesh Chandra **9 - 14**

4. **Studies on the quality of Paneer prepared by using different levels of Sorbic Acid**
   Pashupati Nath, Ramesh Chandra, Tanweer Alam **15 - 20**

5. **Comparative Studies on the quality of creamed cottage cheese prepared by starter culture and direct acidification technique**
   Sateesh Kumar Pandey, Ramesh Chandra and Tanweer Alam **21 - 27**

AF-III

Agricultural Economics & Farm Management,
Agricultural Extension and Rural Development, Home Economics

6. **A study on the distribution system of Guava in Allahabad District of Uttar Pradesh**
   K. Malar Mathi and A. P. Pandey **28 - 33**

7. **Quality of sunnhemp seed available at different local markets of Pratapgarh district of Uttar Pradesh.**
   S. K. Sarkar and S. C. Saxena **34 - 39**

AF-IV

Plant Pathology, Nematology, Entomology, Genetics & Plant Breeding, Plant Protection and other Biological science

8. Genetic Variability Studies in Field Pea
J. Dayal Prasad Babu and Suresh B. G. **40 - 45**

AF-V

Agronomy, Horticulture and Forestry

9. Effect of Different Tillage Practices and Planting Techniques in Rice-Wheat Cropping System on Crop Productivity and Soil Fertility Under Mollisols of Pantnagar
P. John Anurag, R. K. Singh **46 - 51**

AF-VI

Soil and Environmental Sciences

10. Effect on soil properties due to application of different levels of Phosphorous and Sulphur on nutrient uptake and yield of green-gram. *(Vigna-radiata L)* Cv. K-851.
Mukesh Kumar T. Thomas and Arun A. David **52 - 56**

AF-VII

Bio Chemistry, Bio- Technology & Microbiology

11. Influence of Phosphorus and Sulphur on Oil Content and Fatty Acid Profile of groundnut (*Arachis hypogaea* L.)
Mamta Pandey, A.B.Abidi and R.P.Singh **57 - 61**

12. Studies on the effect of Stabilizing Agents in Guava ready to serve (RTS) Drink During Storage
Veeru Prakash and Sandeep Kumar Pandey **62 - 69**

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The Allahabad Farmer Vol. LXII January, 2007 No. 2

Calving interval as influenced by certain genetic and non-genetic factors in Brownswiss crosses with various levels of inheritance

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ABSTRACT

The present study was made to assess the relative importance of certain genetic and non-genetic factors causing variation in calving interval of Brownswiss crosses. The genetic factors were age at first calving (AFC), weight at first calving (WFC), sex of calf born, weight of calf born (WCB) and level of exotic inheritance (1/16,1/8,1/4,1/2) of dams. The non-genetic factor included seasons of calving (winter, summer and rainy). A non-significant influence of WFC, Brownswiss inheritance (BSI) and Season of calving was observed with a significant influence of AFC, sex of calf born and WCB on calving interval.

INTRODUCTION

Long calving interval affects breeding efficiency of dairy animals and consequently the economy of dairy enterprises. Regular and shorter calving interval of dairy animals is a key factor in reproduction and rapid multiplication of the outstanding genetic material through proper breeding plans. Present study was made to determine influence of certain genetic and non-genetic factors on calving interval of Brownswiss (BS) crosses.

MATERIALS AND METHODS

The data on calving interval pertaining to period from 1926 to 1978 of Brownswiss crosses maintained at A.A.I.-D.U., Allahabad were utilized for the present study. The housing, feeding, health care and management practices were uniform. The total of 138 BS crosses were classified into four genetic groups i.e. cows containing ½,1/4,1/8 and 1/16 BS inheritance and data on age at first calving (AFC), weight at first calving (WFC), sex of calf born, weight of calf born and calving seasons were collected.

The data for this study were subjected to statistical analysis using analysis of variance techniques (F-test), Fisher's t-test and critical differences as per the method of **Snedecor and Cochran (1967)**.

RESULTS AND DISCUSSION

The over all mean calving interval in Brownswiss crosses ranged form 13.66-16.85 months.

The data presented in table-1 showed that the shortest calving interval (CI) of 15.76 months was observed in cows of AFC 18-30 months followed by 16.56 months CI in cows of AFC 42-54 months and 16.85 months in cows of AFC 30-42 months and the differences were non-significant, These results are in line with the observations of **Nehra & Chaudhary (1987)**, However, **Yadav and Rathi (1992)** reported a significant influence of AFC on calving interval.

Table-1 :- Influence of various factors on calving interval of cows

(A) Genetic factors					
1. AFC (Months)	18-30	30-42	42-54		
CI (Months)	15.76a	16.85a	16.56a		
2. Wt.of cows	376-425	Above-425	276-325	326-375	225-275
CI (Months)	13.66a	13.72a	14.89a	16.27a	16.30a
3. Sex of calf born	Female	Male			
CI (Months)	14.6a	15.85b			
4. Wt. of calf born(kg)	26-30	Above-30	21-25	17-20	Upto-16
CI (Months)	14.58a	14.61a	15.56b	16.82c	17.05c
5. Level of BSI	1/16BS	1/2BS	1/4BS	1/8BS	
CI (Months)	14.83a	15.18a	15.84a	16.46a	
(B) Non-genetic factor					
6. Season of calving	Summer	Rainy	Winter		
CI (Months)	15.28a	16.65a	15.91a		

Note : Similar alphabets on values indicate non significant differences between values with in the parameter.

The shortest CI of 13.66 months was an observed in cows weighing 376-425 kg body weight followed by 13.72 months CI in cows weighing over-425 kg body weight, 14.89 months CI in cows weighing 276-325 kg body weight, 16.27 months CI in cow of 326-375 kg body weight and 16.30 months CI in cows of 225-275 kg body weight. The differences in calving interval due to body weight of cows were non-significant.

The shortest CI of 14.6 months was recorded in cows which produced female calves than 15.85 months CI in cows which produced male calves as compared to female calves and the differences in calving interval due to sex of calf born were significant. These results do not agree with **Sarkar and Prasad (1997), Lopez et al. (1988),** who observed a non-significant effect of sex of calf born on calving interval.

The shortest CI of 14.58 months was observed in cows which produced calves weighing 26-30 kg body weight followed by 14.61 months CI in cows produced calves more than 30 kg body weight, 15.56 CI in cows which produced calves weighing 21-25 kg body weight, 16.82 CI in cows which produced calves of 17-20 kg, body weight and 17.05 months CI in cows produced calves of less than 17 kg body weight. The differences in these values of calving interval in cows due to weight of calf born were significant. Cows which produced calves of lower body weight (below-25 kg) registered significantly longer calving interval than cows produced calves above-25 kg body weight.

The shortest CI of 15.28 months was recorded in summer season calvers followed by 15.91 CI in winter season calvers and 16.65 months CI in rainy season calvers. The differences in calving interval due to three calving seasons were non-significant, which is in agreement with the findings of **Nehra, *et al*. (1987), Deshpandey *et al.* (1988), Jahageerder *et al.* (1996)** and **Sarkar and Prasad (1997)**. However, the significant differences for calving interval between rainy and winter season calvers were reported by **Reddy *et al.* (1988)**.

The shorter CI of 14.83 months was observed in cows with 1/16 Brownswiss inheritance followed by 15.18 months CI in cows with ½ Brownswiss inheritance, 15.84 months CI in cows with ¼ Brownswiss inheritance and 16.46 months CI in cows with 1/8 Brownswiss inheritance and the differences in calving interval due to different level of Brownswiss inheritance were formed to be non-significant. This was in agreement with the findings of **Verma *et al.* (1974)**.

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Factors affecting service period in Brownswiss crosses with various levels of inheritance

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ABSTRACT

The present study was made to assess the relative importance of certain genetic and non-genetic factors causing variation in service period of Brownswiss crosses. The genetic factors included were age at first calving (months), weight at first calving (kg), sex of calf born, weight of calf born (kg) and level of exotic inheritance (1/16,1/8,1/4,1/2) of dams. The non-genetic factor included seasons of calving (winter, summer and Rainy), A non-significant influence of these factors on service period was observed.

INTRODUCTION

Service period is an important economic trait of dairy cows as it influences reproductive efficiency and has a bearing on lifetime production of dairy cows. The shorter service period reduces generation interval, thus increases the genetic gain per unit of time **(Jain *et al*., 1999)**. As a norm this period should be about 75 days for high level of fertility. Though very short service periods do not allow the animal to prepare completely to carry a foetus and long service periods are not economical. Therefore present study was made to determine influence of certain genetic and non-genetic factors on service period of Brownswiss (BS) crosses.

MATERIALS AND METHODS

The data on service period pertains to a period from 1926 to 1978 of Brownswiss crosses maintained at A.A.I.-D.U Allahabad were utilized for the present study. The housing, feeding, health care and management practices were uniform. The total of 138 BS crosses were classified into four genetic groups i.e. cows containing ½,1/4,1/8 and 1/16 BS inheritance and data on age at first calving (AFC), weight at first calving (WFC), sex of calf born, weight of calf born and calving seasons were collected.

The data for this study were subjected to statistical analysis using analysis of

variance techniques (F-test), Fisher's t-test and critical differences as per the method of **Snedecor and Cochran (1967)**.

RESULTS AND DISCUSSION

The over all mean service period in Brownswiss crosses ranged form 52.11-88.10 days, indicating a high level of fertility, which is similar to the findings of **Prasad (2002)**.

The data presented in table-1 showed that the shortest service period (SP) of 59.87 days SP was observed in cows of 30-42 months AFC followed by 64.22 days SP in cows of 42-54 months AFC and 78.28 days SP in cows of 18-30 months AFC and the differences were non-significant, which is in agreement with observations of **Jain, *et al.* (1999)** and **Prasad (2002)**.

The shortest SP of 62.2 days was observed in cow of more than 325-kg body weight followed by 70 days SP in cows weighing 276-325 kg body weight and 82 days

Table- 1 :- Influence of various factors on Service period (days) of Cows:

(A) Genetic factors					
1. AFC(month)	30-42	42-54	18-30		
SP (Days)	59.87a	64.22a	78.28a		
2. WFC (kg)	Above-325	276-325	225-275		
SP (Days)	62.2a	70a	82a		
3. Sex of calf born	Female	Male			
SP (Days)	63.90a	66.2a			
4. Wt. Calf born (kg)					
(Combined Male & Female)	Upto-16	17-20	Above-30	26-30	21-25
SP (Days)	58.63a	62.2a	65a	72.41a	88.10a
5. Level of BS inheritance	1/8 BS	1/16 BS	1/4 BS	1/2 BS	
SP (Days)	52.11a	56.61a	66.04a	67.2a	
(B) Non-Genetic Factor					
6. Season of calving	Summer	Winter	Rainy		
SP (Days)	66.12a	68.36a	69.77a		

Note : *Similar alphabets on values indicate non significant differences between values with in the parameter.*

SP in cows of 225-275 kg body weight. The differences in service period due to body weight of cows were non-significant.

The shortest SP of 58.63 days was recorded in cows which produced female calves than 62.2 days SP in cows which produced male calves and the differences were non-significant, which do not agree with work by **Neeraj (1993)** and **Sarkar and Prasad (1997)**, who observed a significant effect of sex of calf born on service period in Jersind cows.

The shortest SP of 58.63 days was observed in cows which produced calves weighing upto-16 kg body weight followed by 62.2 days SP in cows produced calves weighing 17-20 kg body weight, 65 days SP in cows which produced calves weighing above -30 kg body weight, 72.41 days SP in cows which produced calves 26-30 kg body weight and 88.10 days SP in cows produced calves of 21-25 kg body weight. The non-significant differences in service period due to weight of calves born, is not in agreement with the observations of **Jadhav and Bhatnagar (1987)**, **Pyne *et al.* (1988)**, and **Chaudhary *at el.* (1989)**, who observed a significant effect of weight of calf born on service periods of cows.

The shortest SP of 66.12 days was recorded in summer season calvers followed by 68.36 days SP in winter season calvers and 69.77 days SP in rainy season calvers and the differences in service period due to calving seasons were non-significant, which in agreement with the findings of **Neeraj (1993)**, **Sarkar and Prasad (1997)** and **Bhoite *et al.* (1998)**.

The shorter SP (52.11days) was observed in cows with 1/8 Brownswiss inheritance followed by 56.61 days SP in cows with 1/16 Brownswiss inheritance 66.04 days SP in cows with 1/4Brownswiss inheritance and 67.2 days SP in cows with 1/2 Brownswiss inheritance and the differences in service period due to different level of Brownswiss inheritance were non-significant. A non-significant effect due to level of exotic inheritance was also reported by **Verma *at el.* (1974), Bhatt *at el.* (1978)** and **Singh and Singh (1994).**

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Organoleptic Study of Different Levels of Sugar on Sweet Cottage Cheese by Direct Acidification Technique

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ABSTRACT

An experiment was carried out with the object to study the effect of different levels of sugar on the sensory evaluation of sweet cottage cheese by direct acidification technique. It was revealed from the results that the treatment T_2 having 25% sugar found highest scores in body, texture, colour& appearance and overall of sweet cottage cheese while the treatment T_4 having 35% sugar did not bring significant improvement in all above attributes. The treatment T_3 registered a tremendous increase in the flavour and taste scores where the sugar content increased to the extent of 30% in the sweet cottage cheese.

INTRODUCTION

Cheese is one of the important fermented dairy product. It is highly nutritious, providing dietary elements that are essential for the human system. The global cheese market is slowly being captured by the Indian producers **(Makhal et al., 2004).** The demand for cheese in India in the year 2005 was estimated to be 30,500 tonnes and growth rate are expected to be more than 15 percent per annum. These special values lie in the nature of proteins, high calcium & phosphorous content as well as easy and complete digestibility of its nutrients. Sweet cottage cheese by direct acidification technique can be suitably made with the addition of sugar instead of salt on laboratory as well as commercial scale. Sweet cottage cheese is palatable for those who do not relish salted and ripened cheese because it contains pleasant sweet flavour and taste, also it supplies good quality proteins.

The present investigation was carried out to find out the effect of different levels of sugar on the quality of sweet cottage cheese by direct acidification technique.

MATERIALS AND METHODS

Sweet cottage cheese was prepared from skim milk. Skim milk was acidified using hydrochloric acid diluted to 50% with distilled water. Milk was coagulated by using Meito rennet @1gm. /100 lts.

Four treatments were used in the experiment are indicated as (T_1) sweet cottage cheese prepared with 20% sugar, (T_2) sweet cottage cheese prepared with 25% sugar, (T_3) sweet cottage cheese prepared with 30% sugar, (T_4) sweet cottage cheese prepared with 35% sugar. For all the treatments the skim milk was standardized to 9% S.N.F. The sensory evaluation was carried out by the panel of five experienced judges based on A 9 point hedonic scale.

Sweet Cottage Cheese Sensory Score Card

Replication No.

9 Point Hedonic Scale

Hedonic rating	Score
Most desirable	9
Highly desirable	8
Moderately desirable	7
Slightly desirable	6
Neither desirable/ undesirable	5
Slightly undesirable	4
Moderately undesirable	3
Very undesirable	2
Most undesirable/Unacceptable	1

Parameter	Treatments			
	T_1	T_2	T_3	T_4
Flavour &Taste score				
Body score				
Texture score				
Colour & Appearance				
Overall acceptability				

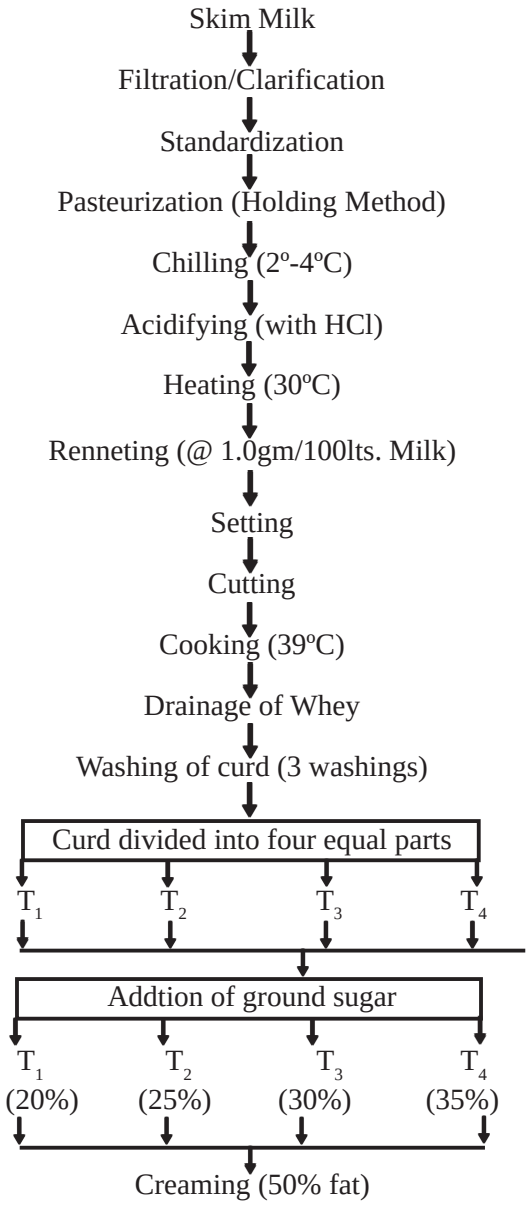
Remarks if any:

Date: Signature

(Name)

Statistical analysis: The data obtained on these parameters were statistically analysed by using analysis of variance and critical difference technique.

Figure: Flow chart of Sweet Cottage Cheese by direct acidification technique



RESULT AND DISCUSSION

Table 1: Average of data obtained on different aspects of sensory evaluation for samples of Sweet Cottage Cheese

Parameters	Treatments			
	T_1	T_2	T_3	T_4
Taste & Flavour	7.54	7.72	7.8	7.2
Body	7.72	7.78	7.62	7.32
Texture	7.58	7.74	7.54	7.28
Colour & Appearance	7.62	7.74	7.56	7.32
Overall acceptability	7.60	7.73	7.63	7.24

Figure-1: Response of different levels of sugar on sensory evaluation of Sweet cottage cheese

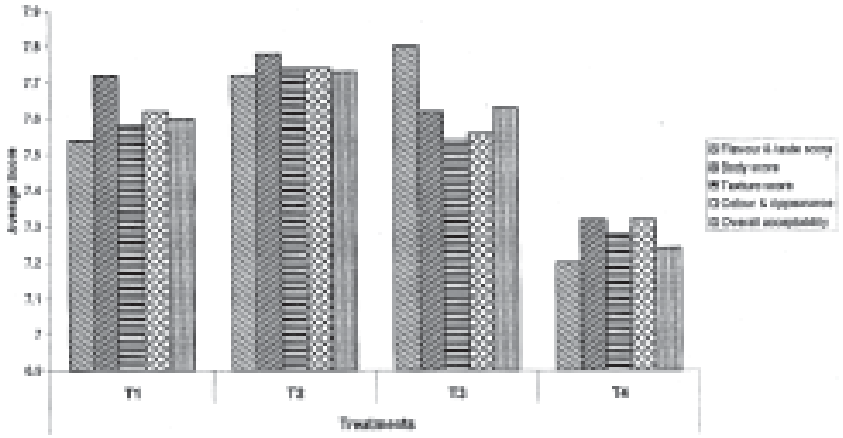


Table-2: Analysis of variance for sensory evaluation of sweet cottage cheese.

Source of variation	d.f	Flavour & Taste	Body	Texture	Colour& Appearance	Overall acceptability
Treatment	3	0.71	0.419	0.363	0.312	0.4667
Replication	5	0.751	0.46	0.44	0.444	0.3895
Error	15	0.085	0.053	0.052	0.025	0.0179

Significant at 5% level

Taste & Flavour : *Table -1 and Fig.1* reveals that the taste & flavour score was highest of T_3 (7.8) followed by T_2 (7.72) >T_1 (7.54) > T_4 (7.2). This indicates that the taste & flavour of cottage cheese added with 30% sugar (T_3) was judged to be best.

Body: It is evident from the *Fig.1* that T_2 was awarded highest score of 7.78 for body followed by T_1 (7.72) > T_3 (7.62) > T_4 (7.32). It appears that a specific range of sugar content improves the body in the finished product of sweet cottage cheese. The higher or lower range of sugar content of T_2 affect on the body of the product.

Texture: It is being observed from the *Fig.1* that the T_2 (7.74) scored highest amongst the treatments followed by T_1 (97.58) >T_3 (7.54) > T_4 (7.28) It is indicated by the observation that a specific range of sugar content improves the texture in the finished product of sweet cottage cheese. Higher or lower range of sugar content than the optimum adversely affect on the texture of the product.

Colour and appearance: It is observed that the T_2 found highest score of 7.74 for colour and appearance, followed by T_1 (7.62) > T_3 (7.56) > T_4 (7.32). The decrease in colour and appearance score was mainly due to dull yellowish colour on the surface of sweet cottage cheese. As for the colour and appearance is concerned the treatment T_2 which contained 25% sugar was found to be most acceptable.

Overall acceptability: It is evident form the *Table-1 and Fig.- 1* that the T_2 had maximum overall acceptability score of 7.73 followed by T_3 (7.63) > T_1 (7.60) T_4 (7.24). Overall scores for the treatments were influenced by the scores of flavour and taste, Body and texture and colour & appearance.

CONCLUSION

It is concluded from the results that the increasing in percentage of sugar over 25% did not have good impact at all on the organoleptic quality of sweet cottage cheese, while sugar less than 25% also did not show a better overall acceptability. Therefore it can be concluded that the cheese with 25% sugar was recommended most desirable by the panel of judges.

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Studies on the quality of Paneer prepared by using different levels of Sorbic Acid

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ABSTRACT

A laboratory experiment was conducted in the department of dairy technology, college of food and dairy technology, A.A.I.(D.U) Allahabad to find the effect of different levels of sorbic acid on the quality and shelf life of Paneer. The buffalo milk used for the preparation of paneer preparation was standardized to 4.5% fat and 8.5% SNF. The different levels of sorbic acid such as 50 ppm (T_1), 100 ppm (T_2) and 150 ppm (T_3) were added into the standardized milk. Paneer prepared from milk without addition of sorbic acid served as control (T_0). Paneer was prepared by adopting the methods suggested by **Bhattacharya *et al*. (1971)** with slight modification like sorbic acid was added prior to coagulation of milk. The different samples of paneer were evaluated chemically and organoleptically after fixed intervals of time.

INTRODUCTION

Paneer is one of the important indigenous dairy products, and used as base material for the preparation of large number of culinary dishes. Buffalo whole milk with 1:1.65 fat and SNF ratio has been recommended for manufacture of good quality paneer. Paneer is highly susceptible to spoilage and does not keep good for more than a day at room temperature, the growth of bacteria yeast and molds are the major causes of spoilage. The growth of these micro-organisms can be checked by the application of certain chemical compounds, known as preservatives. Several attempts have been made to enhance the shelf-life of Paneer by preservatives **(Sachdeva and Singh, 1985).** The preservative used for this study was sorbic acid. Sorbic is an unsaturated fatty acid and it has certain characteristics such as better preserving action against microbial fermentation, helpful in retaining the colour and fairing soluble in the product. The

aims of this investigation were to increase shelf life of paneer and to determine the suitable level of sorbic acid to be used for effective control of micro-organisms in paneer during storage.

MATERIALS AND METHODS

The buffalo milk used for the preparation of paneer was standardized to 4.5% fat and 8.5% SNF. The milk was divided in four lots, and each lot was treated with different levels of sorbic acid such as 50 ppm (T_1), 100 ppm (T_2), 150 ppm (T_3). Paneer prepared from standardized milk without addition of sorbic acid served as control (T_0). Paneer was prepared by adopting the methods suggested by **Bhattacharya *et al.* (1971)** with slight modification like sorbic acid was added prior to coagulation of milk. The different samples were evaluated for fat %, yield, moisture content, fat % in whey, total solids content, standard plate count, yeast and mold count and organoleptic properties. The moisture and protein (micro-kjeldahl method) content of all paneer samples were determined as per **IS: SP: 18 (Part XI), 1981**. The fat % of paneer was estimated as per Gerber method described in **IS: SP: 18 (Part XI), 1981**. Sensory evaluation was done by a 5 panel of judges, for different quality attributes such as taste & flavour, body& texture, colour & appearance and over all acceptability. Data obtained after physico-chemical analysis and sensory evaluation were subjected to statistical analysis by using analysis of variance.

RESULTS AND DISCUSSION

Effect of sorbic acid treatment on physico-chemical properties of Paneer

During the investigation the data collected on different aspects *(Fig.1 and Fig. 2)* were statistically analyzed *(Table 1 and Table 2).* The yield of Paneer in all the treatments was almost same. There was no significant difference in yield between the control and experimental Paneer *(Table 1)*. The addition of sorbic acid does not affected the loss of fat is whey; it was almost same in all the treatments and control groups. The loss of total solid was also not affected by addition of sorbic acid.

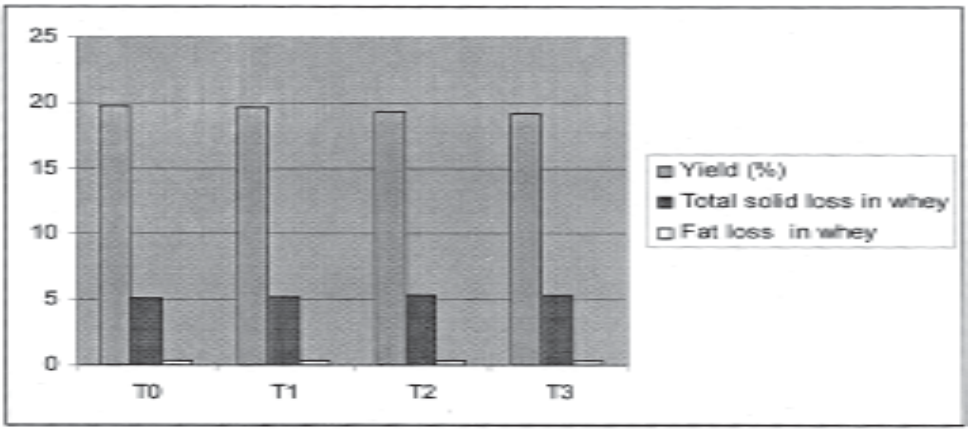

Fig. 1:- Effect of sorbic acid treatment on physico-chemical characteristics of Paneer

Table 1:- Analysis of variance for physico-chemical characteristics of paneer treated with sorbic acid

Source of Variation	M.SS			
	df	Yield	Average Fat loss in Whey	Average Total Solids loss in whey
Treatment	3	27.48	0.0006	3.59
Replication	5	0.047	0.0003	2.38
Error	15	9.1842	0.0002	1.27
CD		NS	NS	NS

* Significant at 5 % level of probability

NS = Non-significant

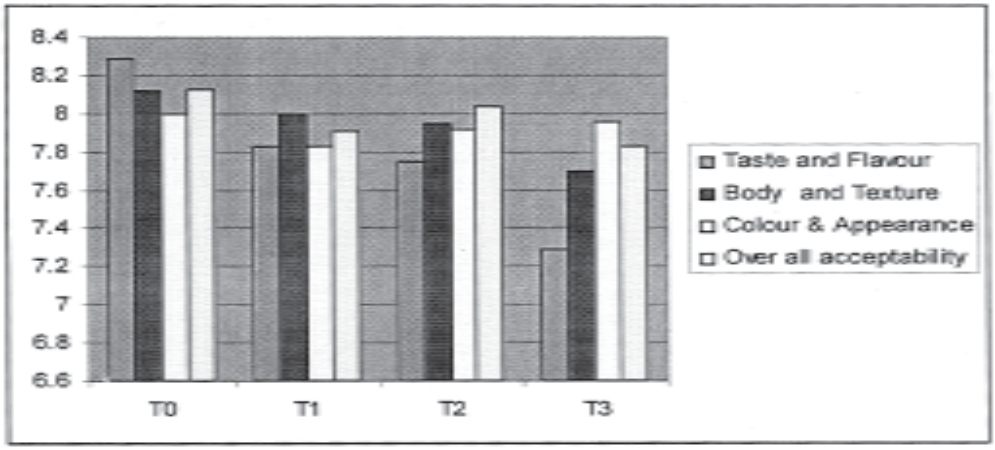

Fig. 2 Effect of sorbic acid treatments on sensory properties of Paneer

Paneer made with 150 ppm (T_3) sorbic acid on the day of manufacture, scored significantly lower flavour scores *(Table 1 and Fig 2)* as compared to the control and all other treatments. Such result was found probably due to the peculiar sorbic acid flavour which might have masked the delicate natural flavour of Paneer. The other sensory attributes such as body & texture, colour & appearance and over all acceptability score of control and other experimental Paneer samples were found to be similar. From perusal of the ANOVA *(Table 3)* it is observed that there was no significant difference between treatments.

Table 2. Analysis of variance for sensory properties of paneer treated with sorbic acid

			MSS		
Source of Variation	df	Taste & Flavour	Body & Texture	Colour & Appearance	Over all acceptability
Treatment	3	1.17	0.190	0.0312	0.059
Replication	5	0.175	0.1711	0.0197	0.058
Error	15	0.28	0.1489	0.1239	0.053
CD		NS	NS	NS	NS

* Significant at 5 % level of probability
NS = Non-significant

Effect of sorbic acid treatment on microbial qualities (Shelf life) of Paneer.

Table-3:- **Average standard plate count ($\times 10^{-3}$) per gm and Yeast and Mould Count ($\times 10^{-1}$) per gm of control and experimental Paneer on 0th, 3rd and 7th days of storage at room temperature.**

Parameters	T_0			T_1			T_2			T_3		
	0 Days	3 Days	7 Days	0 Days	3 Days	7 Days	0 Days	3 Days	7 Days	0 Days	3 Days	7 Days
SPC	54.0	588.3	1614.6	40.8	104.5	163.0	36.0	93.33	161.83	31.0	50.33	155.83
Y& M	26.0	277.1	1118.0	25.6	33.33	39.33	23.66	28.33	32.50	20.33	25.83	29.16

From *Table 2* and *Fig. 3* it is observed that the rate of increase in bacterial population was significantly higher in control Paneer than the experimental samples of Paneer during storage period at room temperature. It is inferred from the result that the sorbic acid helped to check the bacterial growth. **Sachdeva and Singh(1985)** also opined that potassium sorbate has bactericidal effect on paneer by lowing the bacterial count.

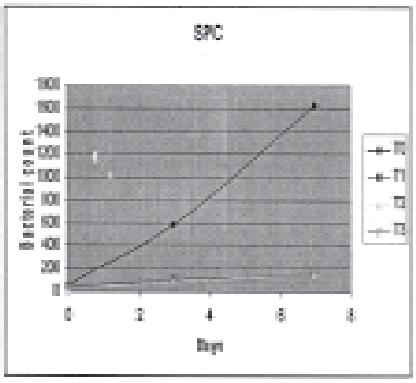

Fig. 3 Changes in SPC

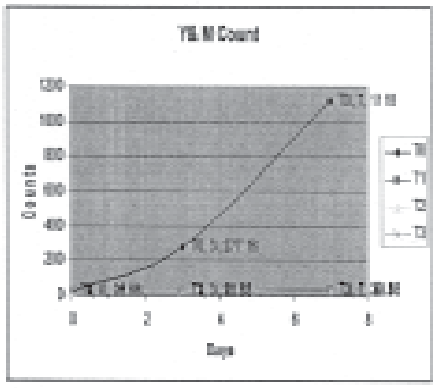

Fig. 4 Change in Y & M count

Perusal from the *Table 2* and *Fig 4* showed that the rate of increase in fungal population was significantly higher in control Paneer than the experimental Paneer during storage. It had revealed that sorbic acid had significant fungicidal effect. **Sachdeva and Singh (1985)** also claimed that potassium sorbate minimizes the Y & M count substantially and enhances the shelf life on paneer.

CONCLUSION

It is concluded from above findings that the addition of sorbic acid decrease the microbial load and enhanced the shelf life of Paneer in descending order 150 ppm (T_3) > 100 ppm (T_2), > 50 ppm (T_1) > T_0 without affecting the quality of Paneer upto 7 days during room temperature. **Sachdeva *et al.*(1985)** also reported that the addition of potassium sorbate (0.1 %) enhanced the shelf life of paneer.

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Comparative Studies on the quality of creamed cottage cheese prepared by starter culture and direct acidification technique

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ABSTRACT

Studies were conducted to find out the comparative effect of starter culture and direct acidification technique on the quality of cottage cheese. Experiment was divided into two equal parts, one part was used for making cottage cheese by making starter culture method (T_0), and another part was used for making cottage cheese by direct acidification technique (T_1). For both treatments the skim milk was standardized to 0.5% fat and 9% SNF.

INTRODUCTION

Cheese is appreciated by consumers for the great interest and variety it adds to the eating experience and is one of the important and popular products in dairy world. It has an excellent image, being perceived as healthy, natural and nutritious **(Kosikowski, 1982)**. The demand for cheese in India in the year 2005 was estimated to 30,500 tonnes. The global cheese market is beckoning the Indian producers **(Makhal *et al*. 2004; Singh and Kanawjia, 1998)**. Cottage cheese is one such variety, which is gaining momentum and is very widely consumed as fresh **(Sabikhi, 1991, Anon, 2005)**. Cottage cheese is having numerous vital food constituents in the form of concentrated protein, calcium and phosphorous. It is also a low calorie source of high quality protein **(Makhal *et al.* 2005)**. Technically the process of cottage cheese manufacturing is simple and can be produced both on small scale as well as large-scale levels. The production of cottage cheese is also possible during lean season with the help of skim milk powder, which is now a value added product. The increasing demand of cottage cheese has generated a need for process and product standardization of the product under Indian conditions. At present the main constraints in the commercial exploitation and limitation of traditional

method is the starter culture failure and its longer incubation period. The present study was therefore designed to overcome this problem. The objectives of undertaking this study were to standardize the processing parameters for cottage cheese prepared by direct acidification and starter culture method and to evaluate products qualities. Samples were evaluated organoleptically and physico-chemically.

MATERIAL AND METHODS

The skim milk was standardized to 0.5% fat and 9% SNF. It was divided into two equal parts, one batch cottage cheese (T_0) was prepared by using starter culture method and second batch (T_1) was used for making cottage cheese by direct acidification technique using HCl. For (T_0) the preparation of cottage the short set method described by **Kosikowski (1982)** was followed and for the preparation of (T_1) the procedure standardized for Mozzarella cheese by **Sabikhi and Kanawjia (1992)** at NDRI, Karnal was followed. For T_1 preparation, the pasteurized and cooled skim milk was taken in a vat and acidified by using conc. HCl @ 3.25 ml/l milk after diluting it with equal amount of distilled water (50% HCl) at 5±1 ^{0}C. Then the temperature of vat was raised slowly to 30 ±1° C. Rennet was added @ 1g/100 l skim milk and vat was left undisturbed for setting of curd. After setting the curd, rest of the procedure was same as starter culture method.

Physico-chemical analysis:- The moisture content of cheese samples was determined by gravimetric method as given in **IS: SP: 18 (Part XI), 1981**. The titratable acidity of samples was determined by the method recommended by the Association of Official Analytical Chemists **(AOAC, 1984)**. For determining the pH, 10 g of the grated cottage cheese sample was mixed with 10 ml of glass-distilled water and slurry was prepared thereof in a mortar. The pH of the slurry was determined by using double junction electrode pH scan 3 +, Eutech Instruments Pvt. Limited, Singapore. The protein content of cheese samples was determined following the procedure delineated by **Kosikowski (1982)** with slight modification. Three g of cheese was accurately weighed, and digestion and distillation were carried out by micro-Kjeldahl method **(Meneffee and Overman, 1940)** using Kjeltec automatic digester and distillation equipment (Tecator make, Sweden).

Sensory evaluation:- The creamed cottage cheese was evaluated by panel of 5 judges with regards to the general colour and appearance, taste and flavour, body and texture and over all acceptability. A 9 point score card (Hedonic scale) was used for this purpose.

Statistical Analysis:- The data obtained after physico-chemical and sensory evaluation were subjected to statistical analysis using paired‘t’ test.

RESULTS AND DISCUSSION

Comparison of physico-chemical characteristics of cream cottage cheese prepared from direct acidification technique and culture method

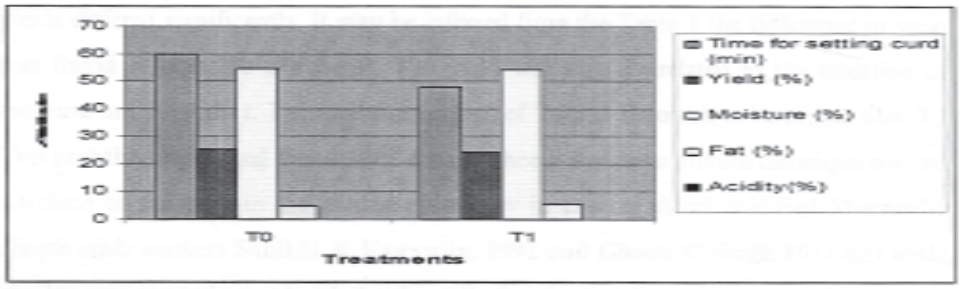

Fig.1 Physico-chemical properties of cream cottage cheeses

Time Taken for Setting the Curd :- The results from *Fig.1*. It was observed that the average time taken for setting of curd in T_1 and T_0 treatment was 47.92 min and 60 min respectively.

Table 1:- Statistical analysis by using paired't' test.

Parameters	t' test
Time taken for setting curd (min)	5.995*
Yield (%)	**5.821***
Moisture (%)	7.791*
Fat (%)	5.227*
Acidity (%)	3.612*
Taste and Flavour	3.112*
Colour and appearance	5.722*
Body and Texture	2.961*
Over all acceptability	1.103

*** Significant**

The results obtained may be due to the more acidity levels at the time of renneting. The data were statistically tested by using paired 't' test. It was also found that there was significant difference between time taken for setting of curd T_0 and T_1. The time taken for setting of curd was directly related to the acidity levels at the time of renneting. Similar results were also being confirmed by **Ernstrom and Kale (1975)**.

Yield of Cottage Cheese

From the *Fig.1* it is observed that the average yields of T_0 and T_1 were 25.48% and 24.53% respectively and that the percentage yield in T_0 were higher than T_1. The data were statistically evaluated by using paired't' test *(Table 1)* and found that the yields differed significantly. It may be inferred from the *Table 1* the difference in yield was found in both the treatments. The yield was directly related to the retention of moisture in the product. The moisture content of T_0 was observed to be higher than T_1. This probably influenced the yield of cottage cheese by starter culture technique and the retention of moisture in the product. Similarly in case of direct acidified Mozzarella cheese other workers **Sabikhi & Kanawjia (1992)** and **Ghosh & Singh (1991)** had made similar opinions and agreed with the above findings.

Fat Content

The average fat content of T_0 was 5.01 and T_1 was 5.61. Since the amount of cream added in both the batches was same however, the fat content of T_0 was found to be slightly lower than that T_1. There was significant difference in fat content between T_0 and T_1 *(Fig.1)*. More fat content in T_1 may be due to more absorption of cream in cottage cheese prepared by direct acidification method. This result is also agreed with the findings of **Hansen (1983)**.

Acidity of Whey

From the perusal of *Fig 1* the acidity of whey obtained was T_0 (0.134) and T_1 (0.124) respectively. The data were also analysed statistically *(Table 1)* and found that the calculated t value differed significantly. The result obtained may be due to the bacterial culture played significant role during the fermentation of lactose lactic acid at every step of cheese making during starter culture technique. Similar findings were also claimed by **(Emmons and Tuckey, 1967)** for cottage cheese and in case of direct acidified Mozzarella cheese were observed by **Sabikhi & Kanawjia, (1992)** and **Ghosh & Singh (1991)**.

Effect on sensorial quality of cheeses prepared from direct acidification technique and culture method

The cottage cheese samples were evaluated organoleptically for different quality attributes such as colour & appearance, body & texture, taste & flavour and overall acceptability.

Colour and Appearance

From the *Fig 2* the average value of T_0 was recorded as 8.1 whereas the average value of T_1 was recorded 8.35. The higher colour and appearance scored was observed for T_1. This results may occur due to using of acid which may bleach the dull appearance of cottage cheese. **Ghosh and Singh (1991)** reported similar effect on mozzarella cheese.

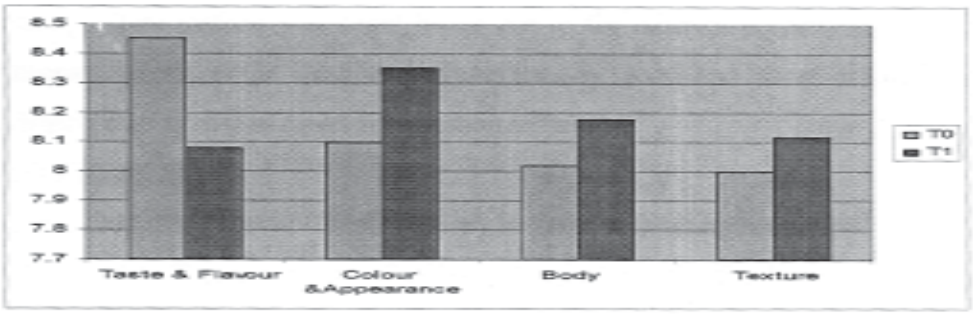

Fig. 2. Effect of direct acidification technique and starter method on sensory qualities of creamed cottage cheese.

Taste and Flavour

There was significant difference in flavour scores of cottage cheese prepared by two different methods. The scores obtained from *(Fig 2)* for taste and flavour of cheese prepared by starter method were higher than that of direct acidification method. This result occurs may be due to the using of starter culture. The data were statistically tested by using paired "t" test. It was found that there was significant difference *(Table 1)* between T_0 and T_1. The higher flavour score of T_0 may be due to the culture added in cottage cheese. **Hansen (1983)** reported that the cottage cheese prepared by starter culture method had given better flavour score.

Body and Texture

From the perusal of *Fig 2*, the texture score of cottage cheese obtained from direct acidification method was similar by the starter culture method. There was no

significant difference in texture score of cottage cheeses prepared by both the techniques *(Table 1)*. The result obtained may be due to behaviour of curd formed and expulsion of moisture from curd in two different methods.

Over all acceptability

There was no significant difference in over all acceptability scores of cottage cheese prepared by two different methods *(Table 1)*. The scores obtained for body texture of cheese prepared by direct acidification (T_1) method was almost similar by starter culture technique (T_0).

CONCLUSIONS

It may be concluded that cottage cheese can be suitably made by direct acidification technique. The quality of cottage cheese prepared by direct acidification technique was of equally acceptable quality. Only flavour of cottage cheese prepared by starter culture method was slight better due to the inherent property of culture used. Otherwise, rest of the qualities were eventually good and to some extent better and advantageous in case of direct acidification technique.

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A study on the distribution system of Guava in Allahabad District of Uttar Pradesh

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ABSTRACT

The changing lifestyle and open economy have forced the manufacturer/suppliers to produce and supply quality products. Due to improper handling, long chain of middlemen, inadequate storage and processing facilities, the post harvest losses is to the tune of 2-30% resulting in monetary loss of several thousand crores. Distributing the horticultural commodities from farm to fork poses a number of problems, which are bottlenecks for getting remunerative price to the producer on one side and availability of products at reasonable price to the consumer on the other side. Guava (*Psidium guajava.l)* is one of the important fruit of India. It is considered to be poor man's apple. It is a very rich and cheap source of vitamin C. Guava is cultivated in 148200 hectares with a production of 163 million tons all over the country. Keeping in view the above facts, the present study was undertaken to analyse the distribution system and the post harvest losses in the whole system.

INTRODUCTION

Fruit farming is one of the most important sectors of the Indian economy. Fruits serve as the natural source of vitamins and minerals. These also supplement the carbohydrates and proteins to varying degrees depending upon their composition.

Guava *(Psidium guajava L.)* is one of the important fruit of India, it is considered to be the poor man's apple. Guava is the fourth most important fruit in India after mango, banana and citrus. Due to its adaptability under wide range of soil and climatic condition larger area laying barren and uncultivable for field crops may be utilized for the cultivation

of guava. Moreover it begins its bearing from the fourth year and reaches the optimum bearing stage in its eighth year or even more. Because of these reasons, many of the farmers have decided to grow guava, with great hope of future satisfaction and prosperity. But most of them are not conscious of possible improvements w.r.t. marketing or post harvest losses. Due to these reasons the return to the producer is not satisfactory.

Due to highly perishable nature of guava fruit, the farmers are interested to sell their produce as soon as possible, so that they could fetch higher prices. Keeping in view the importance of guava, the study entitled *"A study on the distribution system of Guava in Allahabad District of Uttar Pradesh"* was undertaken with the following objectives.

(i) To determine the existing supply chain available for Guava in Allahabad district for distant market.
(ii) To find out the post harvest losses due to the existing supply chain management.

RESEARCH METHODOLOGY

Multi stage sampling design was adopted: -

First Stage	-	Selection of District	-	Purposive-Allahabad
Second Stage	-	Selection of Blocks	-	Purposive-Chail and Mooratganj
Third Stage	-	Selection of Villages	-	Random-Five from each block
Fourth Stage	-	Selection of Guava growers	-	Random- 150

Fifth Stage - Selection of market and market functionaries – Both primary and secondary market and a random sample of 10 percent from each of the intermediaries was drawn from the list of wholesalers/ C.A. and retailers

The period of inquiry for the present study is related to the agriculture year 2004-05. The producer's share in consumers' rupee and marketing efficiency were measured using the following formula:

$$1.PS = \frac{\text{Price received by Producer}}{\text{Retail price}} * 100$$

$$2.\ \text{Marketing Efficiency} = \frac{\text{Consumers' purchase price}}{\text{Total costs and margins}}$$

RESULTS AND DISCUSSION

The present study pertaining to marketing of guava in Allahabad district was carried out and the data were tabulated and analysed. The channels involved in the distribution of fruits to distant markets like Varanasi, Delhi were studied and the data were tabulated and analysed. The channels are:

I. Producer → PHC → WS/ CA $_{(LMF)}$ → WS/ CA $_{(DMF)}$ → Retailer $_{(DMF)}$ → Consumer $_{(DMF)}$

II. Producer → PHC → WS/ CA $_{(DMF)}$ → Retailer $_{(DMF)}$ → Consumer $_{(DMF)}$

III. Producer → WS/ CA $_{(DMF)}$ → Retailer $_{(DMF)}$ → Consumer $_{(DMF)}$

The results of marketing costs, margins and producers' share in consumers' rupee for guava are given in *Table 1*. The producers' share is highest in channel III as the number of middlemen is less. In this channel, the wholesaler of distant market, procures guava directly from the producer. In case of channel I and II, the producers' share is 19.69 and 21.53 percent respectively. In channel I, three intermediaries are present whereas in channel II, two intermediaries operate between the producer and the final consumer. Depending upon the number of intermediaries, the marketing costs also increases. Thus it is high (348.75) in case of channel I low in case of (208) channel III respectively.

Table 1 :- Channel wise price-spread, marketing costs and marketing margin for fresh guava (Distant market with in U.P.)

				(Rs/q.)
S.No.	**Particulars**	**I**	**II**	**III**
1.	**Producers' Sale Price**	**325**	**350**	**485**
	Cost incurred by producer	-	-	-
	(a) Weighing charges	-	-	6
	(b) Miscellaneous	-	-	6
	(c) Total cost	-	-	12
	Absolute Margin of Producer	**-**	**-**	**473**
2.	**PHC's Purchase Price**	**325**	**350**	
	Cost incurred by PHC			
	(a) Transportation charges	25	-	-

	(b) Weighing charges	5	5	-
	(c) Cost of Packaging	10	-	-
	(d) Commission paid (@ Rs.5/Rs.100)	26	-	-
	Total costs	66	5	-
	Absolute Margin of PHC	**134**	**165**	**-**
3.	**Wholesaler/Commission agents Purchase price**	**525**	**-**	**-**
	Cost incurred by WS/CA			
	(a) Mandi fee (@ 2.5% (@ Selling Price)	18.75	-	-
	(b) Other charges	6	-	-
	(c) Total Cost	24.75	-	-
	Absolute Margin of WS/ CA	**200.25**	**-**	**-**
4.	**WS/CA $_{(DM)}$ purchase price**	**750**	**525**	**485**
	Cost incurred by WS/CA			
	(a) Weighing loading charges	8	5	5
	(b) Packaging charges	60	55	52
	(c) Transportation Charges	60	60	60
	(d) Commission paid (@ Rs.5/basket)	25	-	-
	(e) Unloading in D.M.	7	5	5
	(f) Risk factor	15	12	12
	Total cost	177	137	134
	Absolute Margin of WS/ CA	**323**	**518**	**556**
5	**Retailers purchase price**	**1250**	**1180**	**1175**
	Cost incurred by retailers $_{(DMF)}$			
	(a) Transportation Charges	25	26	26
	(b) Commission paid (@ Rs.5/basket)	26	25	25
	(c) Miscellaneous Charges	10	12	11
	Total Costs	81	79	62
	Absolute Margin of Retailer	**329**	**382**	**388**
	Consumers' Purchase Price	**1650**	**1625**	**1625**
6	**Marketing Efficiency**	**0.26**	**0.28**	**0.4**

Marketing efficiency of guava was estimated using Shepherd's index of marketing efficiency. The marketing efficiency of guava was worked out as 0.26, 0.28, 0.4 in channel I, II and III respectively. The difference is due to the marketing costs and marketing margin. The post harvest losses of guava were worked at each stage of marketing in all the above mentioned channels. The results are depicted in table 3. The result reveals that the post harvest losses were highest at producers/PHC and retailers at distant market. At the producer or contractor level, the loss were mostly by fruit fly, parrot, rupturing of fruit at the time of picking, while losses at retailers level were because of handling and loss of weight of the produce.

Table 2 :- Producer's share, marketing cost and marketing margin in the marketing of fresh guava.

(Rs./q)

Channels / **Particulars**	**Distant Market (Within Uttar Pradesh)**		
	I	**II**	**III**
Producers' Share	325 (19.69)	350 (21.53)	473 (29.10)
Marketing cost	348.75 (21.36)	221 (13.6)	208 (12.8)
Marketing Margin	986.25 (59.77)	1065 (65.53)	944 (58.09)
Consumers' Price	1650 (100)	1625 (100)	1625 (100)

*Figures in parentheses show percent in consumers' price

The results indicate that there is a lot of scope of reducing the marketing costs and improving the efficiency of the marketing channel. There is a lot of scope of reducing the marketing costs by adopting appropriate handling, packaging, providing multi storage facilities and following suitable regulatory measures for facilitating the easy flow of guava.

Table 3 :- Channel wise post harvest losses. (Kg.)

Levels Channels	PHC	WS/CA (LMF)	WS/CA (DMF)	Retailer (DMF)
I	9.89 (Rs.29.50)	1.25(Rs 5.50)	5.5 (Rs.5.50)	13.6 (Rs.12.06)
II	9.82 (Rs.29)	-	5.49 (Rs.5.41)	13.2 (Rs.12.00)
III	-	-	5.45 (Rs.5.25)	12.9 (Rs.11.75)

*Figures in parentheses show the economic loss per quintal of guava

CONCLUSION

There is much scope to increase the producers' share in the consumer's rupee, if the number of intermediaries is reduced. Establishing linkages between farmers to consumers is an important aspect of any agri-business. However improving the basic infrastructural facilities and a favourable government vision would further boost the trade of guava in the domestic as well as export markets.

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Quality of sunnhemp seed available at different local markets of Pratapgarh district of Uttar Pradesh.

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ABSTRACT

Sunnhemp seeds were collected from 10 different local markets of Pratapgarh district of Uttar Pradesh, these were tested for different parameters related to seed qualities like seed discolouration, germination, seedling vigour and incidence of seed mycoflora. With respect to the parameters that were tested the seeds were highly poor in comparison to the freshly harvested seed of Sunnhemp Research Station, Pratapgarh.

INTRODUCTION

Sunnhemp (*Crotalaria juncea* L.) is an important bast fibre crop mainly grown in traditional areas for its fine fibre, which is the source of raw materials in cottage industry for the preparation of strings, ropes, twines, tat patties etc. Apart from fibre it is also largely cultivated as green manure. In Uttar Pradesh, it is mainly grown in the Eastern part. One of the major constraints in sunnhemp cultivation is the non-availability of quality seed **(Nath et al; 1981)**. There is no agency for production and distribution of sunnhemp seed either at state or central level. Moreover, no seed standards are fixed for sunnhemp seed. Thus, whatever seed is produced in the hilly tracts of Sonbhadra and Mirzapur district of Uttar Pradesh and adjoining districts of Madhya Pradesh reach the local markets, which is purchased by the farmers. So far, the quality of such seeds is not tested. Due to non-availability of quality seed, farmers often face the problem of poor stand in the field, which has a direct bearing on the yield. Besides, sunnhemp seed loses its viability very fast in tropical countries. That is why a wide range of seed rate is also reported in literature **(Kundu, 1964, Ghumary and Bisen, 1967)**. Therefore, the present need based investigation was carried out during 2002 to assess the quality aspects (seed discolouration, seed mycoflora and seedling vigour) of seed purchased by farmers from the local markets.

MATERIALS AND METHODS

Assessment of seed discolouration

Assessment of seed discolourtion was determined visually by separating the discoloured seed from the seed lots collected from 10 different locations of Pratapgarh district. Fresh seeds collected from Sunnhemp Research Station were treated as check. Further, the discoloured seeds were grouped into four on the basis of seed coat discolouration.

Seedling vigour

To represent the seedling vigour, germination, root length, shoot length, green weight and dry weight was recorded. Germination of seed was determined after five days by growing 400 seed in a plastic tray of 40cm x 75cm under glass house condition. Three replications were maintained for each sample. Root length, shoot length, green weight and dry weight (by oven dry method) of seedlings on per plant basis were recorded after 30 days of sowing.

Detection and identification of seed borne fungi

Seed borne fungi were detected by Agar Plate Method **(ISTA, 1996)**. Identification based on observations of characteristics of fungal colony, fruiting bodies and spores of the fungus were done with the help of identification manual **(Ahmed and Reddy, 1993 and Subhramonian, 1971)**.

Statistical analysis of data were done in CRD.

RESULTS AND DISCUSSIONS

Seed discolouration

Four types of discoloured seed namely spotted seed, dull discoloured seed, light brown seed and dark brown seed were detected in all the samples. The main characteristics of each group is described below.

In spotted discoloured seed, regular to irregular dark brown spot of varying size were observed on the seed surface. Spots were mainly confined to seed coat and the affected seed looked as bold as healthy seed. In dull discoloured seed, dull greenish - yellowish seed coat was observed. Some times corky growth of irregular size was also noticed on the seed surface. Seed size and boldness was also reduced. In light brown discolouration the colour of the whole seed coat changed to light brown. Boldness of the seed was similar to those of healthy ones. In dark brown discoloured seed,

depressed, dark brown, irregular spots were noticed which not only confined to the seed coat but also extended to the cotyledon and embryonic region. Seed appeared shriveled and the size, weight and boldness were reduced greatly.

The incidences of all the discoloured seed taken together and the results are presented in *Table - 1*. Statistically seed discolourations were much higher in samples collected from local markets than the freshly harvested seed. Seed discolouration due to field and storage fungi is a common problem in various seeds. The discolouration was observed to have increased with degree of infection in the field, period of storage and condition of storage **(Agarwal and Sinclaire, 1997)**. The result thus obtained implies that the seed coming into local markets are not sorted and stored properly.

Table 1: Germination, seed discolouration and seed mycoflora in the seed of sunnhemp collected from different local markets.

Source of seed	Discoloured seed (%)	Germination (%)	Seed mycoflora (%)
Antu	17.8 (24.8)	55.7 (50.2)	22.3 (30.1)
Patti	16.3 (23.8)	55.0 (47.8)	21.7 (30.0)
Katra	14.3 (22.0)	50.4 (45.4)	22.3 (30.5)
Babaganj	15.0 (22.7)	53.6 (47.6)	18.3(25.1)
Channya	12.3 (20.5)	51.6 (46.3)	18.0(24.8)
Sarawa chandrika	11.3 (19.5)	56.5 (50.4)	21.3 (29.7)
Chilbilla	13.0 (21.1)	52.6 (47.3)	22.0 (30.1)
Tengua	16.3 (23.8)	51.3 (45.8)	20.0(28.1)
Durganj	18.7 (25.8)	56.0 (50.4)	18.0(24.8)
Balipur	15.6 (20.5)	61.3 (51.6)	20.0 (28.2)
Sunnhemp Res. Stⁿ (Check)	6.0 (14.0)	85.3 (67.7)	6.7 (15.1)
CD (0.01)	9.17	4.75	6.5
C.V.	7.80	9.40	10.2

Each value in the table is the mean of three replications each containing 400 seeds.

Figure in the parenthesis represent angular value.

Germination and seedling vigour

Germination of seed collected from different places varied significantly *(Table 1 and 2)*. The extent of germination varied from 50.4% (from Katra) to 61.3% (from Balipur), which are much below than that of the fresh seed (85.3%) collected from Sunnhemp Research Station, Pratapgarh. Statistically seed from all the places (except Sunnhemp Research Station and Balipur) are at par with regard to germination.

Seedling vigour represented by shoot length, root length, green weight and dry weight are presented in *Table - 2*. Shoot lengths of seedlings collected from different local markets were significantly less in comparison to the freshly harvested seed. Unlike shoot length, root length did not differ significantly amongst the seed collected from

Table 2: Observation on seedling vigour of seeds of different local markets.

Source	Shoot length (cm)	Root length (cm)	Gr. Weight (g)	Dry weight (mg)
Antu	24.6	3.2	2.3	336.6
Patti	23.3	3.2	2.3	320.0
Katra	25.0	3.8	2.2	313.3
Babaganj	24.0	3.2	2.3	323.3
Channya	24.3	2.8	2.2	301.6
Sarawa chandrika	22.0	3.0	2.2	316.6
Chilbilla	23.3	3.8	2.3	310.0
Tengua	24.3	3.2	2.0	263.3
Durganj	24.3	3.2	2.5	331.6
Balipur	27.3	3.3	3.1	313.3
Sunnhemp Res. St^{n}. (Check)	30.6	4.2	3.3	393.3
CD (0.01)	2.4	NS	0.43	58.7
C.V.	4.2	15.05	8.07	7.9

The data are on per plant basis

Value in each table is the mean of three replication each having 20 seedlings

different local markets. However, higher root length was recorded in freshly harvested seed. Green weight as well as dry weight of seedling of seed collected from different local markets was significantly less in comparison to freshly harvested seed except Balipur.

Seed mycoflora

In all, eight different fungi namely *Aspergillus flavus, A. niger, Alternaria, Fusarium udum, Curvularia lunata, R. solani M. phasolina and Colletotrichum* were detected from different seed samples. Except *A.flavus* the incidence of other fungi were higher in seed collected from different local markets *(Table - 3)*. The same fungi were also isolated by **Pal and Basuchoudhury, (1980) and Sarkar and Tripathi (2000)**.

Table 3: Incidence of seed mycoflora in sunnhemp seed collected from different local markets.

Source of seed	Incidence of seed mycoflora(%)								
	Asn	*Asf*	*Curl*	Alt	*Fusu*	*Macp*	*Rhis*	*Coll*	Total
Antu	4.0	4.0	0.0	4.3	5.0	1.0	4.0	0.0	22.3
Patti	3.3	4.0	1.3	0.0	4.9	3.0	3.3	1.0	21.7
Katra	4.0	2.0	4.0	0.7	4.9	2.3	3.7	0.0	22.3
Babaganj	4.0	1.0	2.0	0.3	4.9	3.0	2.7	0.0	18.3
Channya	4.0	0.3	1.3	0.3	4.3	3.0	3.3	0.7	18.0
Sarawa chandrika	3.0	2.3	1.3	3.3	4.0	1.0	5.0	0.3	21.3
Chilbilla	5.3	1.3	1.0	0.0	6.0	3.0	4.0	1.0	22.0
Tengua	4.0	1.0	0.3	0.0	4.0	4.0	6.3	0.0	20.0
Durganj	4.0	1.0	0.0	0.7	4.0	2.7	4.7	0.7	18.0
Balipur	4.0	0.4	0.0	1.3	3.0	4.0	3.0	0.3	20.0
Sunnhemp Res. Stn. (Check)	2.0	1.7	0.7	0.0	3.0	0.0	2.0	0.0	6.7
Average	3.8	1.7	1.6	1.0	4.4	2.4	3.8	0.4	

***Asn**=Aspergillus niger, **Asf**=Aspergillus flavus, **Curl**= Curvularia lunata, **Alt**= Alternaria, **Fusu**= Fusarium udum, **Macp**= Macrophomina phaseolina, **Rhis**= Rhizoctonia solan, **Coll**=Collectotrichum.*

Each value in the table is the average of 75 seeds.

These fungi are responsible for deteriorating the quality of seed. The higher incidence of seed mycoflora may be attributed to improper storage as well as degree of infection in the field **(Agarwal and Sinclare, 1997 and Maude, 1995)**. Thus attention is to be paid to produce and distribute quality seed to the farmers. But so far there is no minimum seed standard for sunnhemp. Very recently initiatives have been taken by Seed Committee to decide the minimum standard of sunnhemp seed **(Anonymous, 2001)**.

Therefore, it is high time to strictly follow the seed standard during purchase of seed from local markets. At the same time centralized or decentralized (non-governmental) seed policy involving small scale seed production or distribution enterprises at farm or village level is essential to make the crop profitable.

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Genetic Variability Studies in Field Pea

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ABSTRACT

A field experiment was conducted on field pea during rabi 2004-2005 with 20 genotypes in three replications to asses the genetic variability present in the study material. Genetic variability, heritability and genetic advance for eleven metric characters were studied for 20 field pea genotypes. The highest genotypic and phenotypic coefficient of variation was observed for grain yield per plant , number of pods per plant, number of clusters per plant and plant height. High heritability estimates were found for almost all the characters studied except for pod length. High heritability estimates coupled with higher genetic advance were obtained for plant height, number of clusters per plant, number of pods per plant and 100-seed weight.

INTRODUCTION

Assessment of genetic variability in the available germplasm is a pre-requisite for any breeding programme. The breeder selects better genotypes based on their phenotypic expression. The estimates of phenotypic and genotypic variances for various characters and their heritability are important components in selecting the best genotypes. The heritability plays and important role in selection for the desirable characters. The estimates of heritability along with genetic advance are helpful in designing successful breeding programme.

MATERIAL AND METHODS

An experiment consisting of 20 field pea germplasm was carried out in rabi 2004-2005 at the field experimental farm of the Department of Genetics and Plant Breeding, College of Agriculture, AAI-DU, Allahabad. Each germplasm was considered as treatment and planted in randomized block design in three replications. Each genotypes was sown in single row plot of 4 m length with row to row spacing of 35 cm. Observations were recorded on 10 randomly selected plants from each genotype in each replication

for 11 characters *(Table 1)*. Mean values of 10 plants were subjected to statistical analysis **(Panse and Sukhatme, 1967)** and test of significance was carried out by F values **(Goulden, 1952)**. The genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) and the heritability in broad sense was estimated as per **Burton and De Vane (1953)**. Expected genetic gain was worked out as per the method given by **Lush (1949)**.

RESULTS AND DISCUSSION

Analysis of variance *(Table 1)* revealed that considerable variability is present among the genotypes for all the characters studied except for days to 50% maturity. Maximum variability was recorded for plant height and number of pods per plant. Positive wide spectrum of variability noticed in these characters would offer scope of selection for evolving the promising types both at genotypic and phenotypic level. Low variance was observed for pod length, number of seeds per pod and number of primary branches. Similar results were reported earlier by **Amarendra *et al.* (2003)** and **Sharma *et al.* (2003)**.

All the characters except pod length showed narrow differences between the values of GCV and PCV *(Table 2)*, implying variability due to genetic contribution. The GCV values were higher for grain yield per plant, number of pods per plant, number of clusters per plant and plant height *(Table 2)* indicating that high magnitude of genetic variability existed for the above traits, and thus offering a good opportunity for improvement through selection. This finding is in consonance with the findings of Vikas **Singh and Singh (1999)** and **Pathak *et al*. (2002)**.

Although genotypic coefficient of variation helps to measure the genetic variability in a character, it is not possible to partition the heritable variation with this alone. Burton suggested that GCV together with heritability estimates would give the best result of the amount of genetic advance to be expected from selections. High estimates of broad sense heritability were obtained for all the characters under study except pod length *(Table 2)*. This might be possible due to low impact of environment on these traits. High values of heritability for various characters in pea were also reported by **Sureja and Sharma (2000) and Shinde (2000)**. Days to 50% flowering, days to 50% maturity, number of primary branches, number of seeds per pod, 100-seed weight and protein content had high heritability inspite of low GCV. This might be due to the introduction of replications into the systems **(Burton and De Vane, 1953)**.

Table 1: ANOVA for eleven characters in 20 field pea genotypes.

Source of variation	d. f.	Days to 50% flowering	Days to 50%	Number of maturity branches	Plant height primary	Number of clusters per plant	Number of pods per plant	Pod length	Number of seeds per pod	100-seed weight	Grain yield	Protein content
		Mean sum of squares										
Replication	2	3.65	207.17	0.17	47.76	0.69	0.93	0.54	0.98	4.23	9.18	0.19
Genotype	19	521.01**	465.04	2.59**	16625.15**	1114.58**	2017.40**	1.18**	1.42**	52.22**	671.43**	40.24**
Due to error	38	13.26	220.48	0.12	29.56	2.31	12.01	0.74	0.41	1.13	2.05	0.10
C.D. (P=0.05)		6.02	24.54	0.571	9.00	2.51	5.73	0.45	0.33	1.76	2.36	0.53
CV		5.66	11.82	8.25	3.10	4.42	7.58	4.59	5.37	5.96	7.09	1.40
S.E. d (+)		2.10	8.57	0.19	3.14	0.87	2.00	0.49	0.36	0.61	0.82	0.18

* At 5% level of significance

** At 1 % level of significance

Table 2: Estimates of components of variance for 11 characters of 20 field pea genotypes.

S. No	Characters	VE	VG	VP	ECV	GCV	PCV	h^2 (broad sense)	GA
1.	Days to 50% flowering	13.26	169.25	182.51	5.66	19.61	20.46	91.8	24.95
2.	Days to 50% maturity	220.48	64.15	79.54	3.08	6.29	7.01	80.6	14.82
3.	Number of primary branches	0.12	0.83	0.95	8.25	21.68	23.20	87.3	1.75
4.	Plant height	29.65	5531.81	5561.49	3.10	41.51	44.24	88.0	138.06
5.	Number of clusters per plant	2.31	370.76	373.06	4.41	55.92	56.10	99.4	39.50
6.	Number of pods per plant	12.01	669.90	682.04	7.61	56.52	57.10	98.2	52.82
7.	Pod length	0.074	0.37	0.44	4.59	11.09	31.71	12.2	0.050
8.	Number of seeds per pod	0.410	0.46	0.50	5.37	17.97	18.73	91.7	35.47
9.	100-seed weight	1.13	17.03	18.16	5.96	23.11	23.87	93.8	8.23
10.	Grain yield per plant	2.05	223.13	225.18	7.09	74.44	75.07	98.3	30.95
11.	Protein content	0.10	13.38	13.48	1.40	15.88	15.95	99.1	7.52

The heritable variation can be estimated with greater degree of accuracy when heritability is studied along with genetic advance. A high heritability coupled with high genetic advance gives most effective criteria for selection **(Johansen *et al.* 1955)**. Heritability along with genetic advance would be helpful in assessing the nature of gene action. In the present study, high heritability estimates coupled with high expected genetic advance (as percentage of mean) were observed for plant height, number of pods per plant, number of clusters per plant, number of seeds per pod and grain yield per plant *(Table 2)* indicating that heritability for these characters might be due to additive gene action. Therefore, these characters could be considered as reliable selections indices.

High heritability along with low genetic advance was noticed for protein content, 100-seed weight, days to 50% flowering, number of primary branches and days to 50% maturity indicating that these characters are controlled by non-additive gene action and improvement through selection for these characters would be rather ineffective. Similar results in pea were also reported by **Kumaran *et al.* (1995)** and **Mahanta *et al.* (2001)**.

It can be concluded from the present study that plant height, number of pods per plant and number of clusters per plant showed high variability, GCV, heritability and expected genetic advance (as percentage of mean). Hence, these traits could be used as selection criteria for development of effective and productive plant type in field pea.

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Effect of Different Tillage Practices and Planting Techniques in Rice-Wheat Cropping System on Crop Productivity and Soil Fertility Under Mollisols of Pantnagar

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ABSTRACT

A field experiment was conducted at Govind Ballabh Pant University of Agriculture &Technology, Pantnagar during 1998-2000 to study the effect of various crop establishment methods both in rice and wheat on crop productivity and soil fertility. Direct seeded rice had significantly higher number of panicle than transplanted rice. But number of grains per panicle were more in the latter than former. Length of panicle and test weight were not affected by the method of crop establishment, green manure or deep tillage. Treatments of rice crop establishment had no significant influence on wheat yield and its attributes and the interaction between *kharif* tillage and *Rabi* tillage was not significant. Bulk density of zero tillage plots was found to be higher than all other treatments whereas infiltration rate was highest on bed planting of wheat than other treatments.

INTRODUCTION

Modern day research on rice-wheat cropping system includes various tillage practices and planting techniques along with residue management and green manure incorporation. This system is the most important cropping system in the world covering approximately 24 million hectares and feeds around one billion people in continent Asia **(Ladha *et al*., 2000)**. During last three decades, rice-wheat production system has shown remarkable resilience in productivity growth. The scientists around the world are worried and concerned about the sustainability of this exhaustive cropping system. But the system has proven itself as a successful one in Indo-Gangetic plains, especially

in *Tarai* belt. *Tarai* soils are alluvial in nature having high moisture regimes or greater annual average moisture content. These are generally low to medium in available P, medium to high in available K and high in organic matter. Available sulphur is marginal in some pockets. Zinc deficiency in rice is widespread. A very high percentage of cropped area is irrigated and the fertilizer use is quite high, nearly 300 kg NPK/ ha/ year, which is quite high resulting in high productivity. There are short as well as long term issues related to tillage, crop establishment, nutrients and crop residue management.

MATERIAL AND METHODS

Experiment was laid out in strip plot design having four replications at Crop Research Center of GBPUA &T, Pantnagar. Rice (*var*. Pant Dhan 4) was sown during *Kharif* 1998 and 1999 followed by wheat (*var*. UP 2338) during *Rabi* season of both the years. For *Kharif* season four treatments of rice were taken viz., T_1: conventional puddling and transplanting; T_2: green manure (GM) + T_1; T_3: deep tillage + T_2 and T_4: deep tillage, direct seeding of rice, and in *Rabi* season four treatments for wheat were sown viz., T_1: conventional tillage (4 harrowings – planking – sowing by seed drill – planking); T_2: zero till drill; T_3: Strip till drill; T_4: Chinese drill.

Sesbania was sown in April 1998 for green manure in two rice treatments which was incorporated into soil after 55-58 days after sowing. Then, plots were flooded for the decomposition of green manure, after which it was puddled for rice transplanting. Sowing of direct seeded rice was done on June 5 during 1998 and 1999 and on the same day nursery was sown for the other three treatments. A uniform dose of 150 kg N and 60 kg P_2O_5 ha^{-1} along with 20 kg $ZnSo_4$ ha^{-1} was applied in all plots. Rice was harvested in the month of October.

Wheat was sown during the 1st fortnight of December as per treatments. Sowing got delayed due to unusual late rains during these two years. The plot being low-lying, remained wet. Uniform dose of 150 kg N and 60 kg P_2O_5 ha^{-1} was applied in all plots. Crop was harvested during 1st fortnight of May.

RESULTS AND DISCUSSION

(A) Biomass Production by *Sesbania* (Green Manure)

Sesbania crop raised before rice in summer in two treatments produced 5.75 and 6.02 t ha^{-1} during (998 and 1999 respectively. **Choudhary *et al.*, (1995)** reported similar results.

(B) Rice

Number of panicles was significantly higher in direct seeded rice than transplanted rice under conventional planting (T_1*), (Table 1)*. Green manure increased the number of panicles but was non significant. Number of grains per panicle was nearly 11-16 per cent higher in transplanted crop compared to direct seeded crop in two years. Length of panicles and test weight was not affected by the methods of crop establishment, green manuring and deep tillage. Rice yield was highest (5822 kg ha^{-1}) in plots where deep tillage was done followed by *Sesbania* green manuring, puddling and transplanting. However, the treatment differences were not significant. Direct seeded and transplanted crops yielded at par. The effect of green manuring was not significant as the crop had received 150 kg N ha^{-1} as fertilizer (urea) nitrogen. It is evident that during the second season of rice *(Tables 1 and 2)*, there was a considerable decline in the yield which shows the productivity drop because of continuous cultivation of this cropping system on the same fields for many years.

Table 1: Yield and yield attributes of rice as influenced by tillage and planting treatments.

Treatments	No. of panicles/ m^2 at harvest		Panicle length (cm)		No. of grains / panicle		Test weight (g)		Grain yield (kg ha^{-1})		Mean yield (kg ha^{-1})
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	
T_1	261	253	27.4	27.2	120	127	28.9	27.7	5628	5572	5600
T_2	280	275	27.1	27.9	121	130	30.0	29.2	5616	5657	5612
T_3	285	275	27.2	27.6	101	103	27.7	27.1	6011	5634	5822
T_4	310	290	26.8	27.0	103	114	28.3	28.6	5744	5432	5588
CD at 5%	35	30	ns	ns	ns	ns	ns	ns	ns	ns	-

(C) Wheat

Due to very late sowing, the growth and yield of the crop was relatively less *(Table 2)*. Treatments of rice crop establishment had no significant influence on yield and yield attributes and the interaction between *Kharif* tillage and *Rabi* tillage was not significant. **Singh (1992)** reported the same results from Pantnagar because of sandy loam soil texture, whereas the results were contradicting with the findings of **Joshi (1976)** who conducted the similar experiment in silty clay loam soil.

Table 2:- Yield and yield attributes of wheat as influenced by different tillage and planting treatments.

Treatments	Plant height (cm)		No. of ears/ m^2		No. of grains/ ear		Grain yield (kg ha^{-1})		Mean grain yield
	1998	1999	1998	1999	1998	1999	1998	1999	
Kharif tillage									
T_1	75.9	69.2	260	263	73.9	72.0	4123	3813	3968
T_2	73.7	66.3	265	279	75.2	77.0	3689	3813	3751
T_3	78.0	72.1	232	260	74.3	76.0	3902	3883	3892
T_4	80.0	70.6	280	293	77.3	82.0	4470	4032	4251
CD at 5%	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	
Rabi tillage									
T_1	78.6	67.7	276	257	74.0	68.0	4304	3878	4091
T_2	79.9	68.9	293	263	76.3	73.0	4442	4103	4272
T_3	76.0	67.0	263	260	69.0	70.2	3533	3687	3610
T_4	78.0	66.3	298	266	74.6	72.1	4254	4034	4144
CD at 5%	3.0	3.1	33	-	-	-	364	Ns	-

However, during the second year, highest wheat yield was recorded in plots where rice was directly drilled and was less in plots where puddling was done in previous season. Plant height of the crop sown by strip till drill was lower than conventional and zero tillage. Other treatments were at par. Number of ears in unit area was also higher in plots sown with Chinese drill and Zero till drill and it was lowest with strip till drill. Number of grains per ear was not affected by tillage treatments. During 1999-2000 all the planting drills were similar in producing wheat yield. **Sen *et al.*, (2002)** and **Hurby (1989)** reported similar findings.

(D) Soil Physical Properties

Soil physical properties were recorded after harvest of wheat in all treatments. Bulk density in both the depths (0-8 cm, 8-16 cm) was highest in zero tillage treatment and lowest in conventional tillage *(Table 3)*. This was because of natural soil consolidation and minimum disturbance of soil by tillage operations in zero tillage. This effect was

Table 3: Soil physical properties at wheat harvest.

Treatments	Bulk density (mg m^{-3})				Infiltration rate (cm hr^{-1})	
	Soil depth (cm)					
	0 – 8 cm		8 – 16 cm			
	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
T_1	1.29	1.31	1.34	1.39	1.50	1.46
T_2	1.53	1.49	1.56	1.53	2.66	2.55
T_3	1.42	1.44	1.43	1.48	1.10	1.18
T_4	1.42	1.40	1.46	1.43	1.40	1.16

noted by several other workers **(Yoshida *et al.*, 1991; Chanye and Lindwall, 1992)**. Infiltration rate was highest on beds due to loose elevated bed structure where roots occupy major area and lowest in strip till drill.

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Effect on soil properties due to application of different levels of Phosphorous and Sulphur on nutrient uptake and yield of green-gram (Vigna-radiata L) Cv. K-851.

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ABSTRACT

A field experiment was conducted during kharif season of 2002 in plot no. 100 at the Crop Research Centre Allahabad Agricultural Institute-Deemed University, Allahabad. to study the **"Effect on soil properties due to application of different levels of Phosphorous and Sulphur on nutrient uptake and yield of Green-gram (*Vigna-radiata* L)"**. The results indicated that three levels of Phosphorous (0,60 and 90 $kgha^{-1}$) and three levels of Sulphur (0,25 and 40 $kgha^{-1}$) and their Int. (P x S) it was observed that P_{90} S_{40} treatment combination gave better performance than the corresponding levels of phosphorous, sulphur and their Int. (P x S) effect on soil properties were significantly change except pH at (P Levels) and EC at Int. (PxS).

INTRODUCTION

India is a major pulse growing country of the world accounting roughly for the one third of the total world area under pulses and one fourth of the total world production. Pulse are most important in Indian agriculture because pulse are more drought resistant than cereals it has capacity to fixed the atmospheric nitrogen, which makes a good cover crop and binds the soil particles and also help in preventing soil erosion. Phosphorous and Sulphur as more needs and major fact of pulses.

Without an adequate supply of phosphorous in soil plant grouth rate is slow, yield are low and quantity is poor.

Today the demand of sulphur in all crops is being role placed as a balanced fertilizer use for yield increase due to sulphur application has marked effect on soil properties and is used as soil amendments **(Tondon and Mersick 2001)**.

MATERIALS AND METHODS

Allahabad is situated at altitude of 98m above sea level at 25.57^0 North latitude and 81.5^0 East longitude. The physico-chemical characteristics of the soil were : Texture-sandy loam, Db 1.41 g/cc, Dp 2.47 g/cc, pH 7.40 , EC 0.38 dSm^{-1}, O C 0.43%, available N,P,K and S were 300 kg ha^{-1}, 28.0 kg ha^{-1}, 149.86 kg ha^{-1} and 5.85 ppm respectively. The main experiment was carried out in 3^2 factorial design with nine treatments having different combinations of phosphorous and sulphur fertilizer used as the entire amount of P and S in the form of Di-ammonium Phosphate and elementry Sulphur respectively was applied basally.

The objectives of the present study were:

(i) To study the effect of different levels of phosphorous on nutrient uptake and yield of green- gram.

(ii) To study the effect of different levels of sulphur on nutrient uptake and yield of green-gram.

(iii) To study the Interaction between phosphorous and sulphur levels on nutrient uptake and yield of green-gram

(iv) To study the change in physico-chemical properties of soil due to different treatment combinations.

RESULTS AND DISCUSSION

Table 1. Change in physico-chemical properties of soil due to different treatment comions:

Change in physico-chemical properties									
Treatments	Db (g/c.c)	Dp (g/c.c)	pH (1:2)	EC (dSm^{-1})	OC (%)	N (Kg ha^{-1})	P (Kg ha^{-1})	K (Kg ha^{-1})	S (ppm)
Pre sowing After harvesting	1.41	2.47	7.40	0.38	0.43	300	28.5	149.86	5.85
P_0S_0	1.56	2.57	7.37	0.37	0.41	260	15.20	121.30	4.59
P_0S_{25}	1.51	2.50	7.56	0.43	0.53	319	18.10	130.10	6.11
P_0S_{40}	1.64	2.60	7.32	0.36	0.46	281	26.96	136.34	6.75
$P_{60}S_0$	1.60	2.63	7.42	0.39	0.47	284	30.50	140.0	5.31
$P_{60}S_{25}$	1.55	2.56	7.46	0.42	0.49	310	32.02	138.72	6.30
$P_{60}S_{40}$	1.58	2.60	7.28	0.36	0.48	300	33.83	142.40	7.20
$P_{90}S_0$	1.50	2.53	7.43	0.41	0.50	321	39.23	145.20	5.52
$P_{90}S_{25}$	1.49	2.48	7.69	0.46	0.67	382	28.84	134.14	6.01
$P_{90}S_{40}$	1.63	2.60	7.15	0.35	0.48	318	42.59	148.40	8.20
S.E P m ±	0.011	0.011	0.033	0.007	0.012	0.81	0.35	0.63	0.13
C.D. P at 0.05	0.023	0.024	0.071	0.016	0.027	1.72	0.75	1.34	0.29
S.E. S m±	0.011	0.011	0.033	0.007	0.012	0.81	0.35	0.63	0.13
C.D. S at 0.05	0.023	0.024	0.071	0.016	0.027	1.72	0.75	1.34	0.29
Int. (P x S) S.E. m ±	0.019	0.02	0.058	NS	0.022	1.40	0.10	1.10	0.24
Int. (P x S) C.D. at 0.05	0.040	0.042	0.123	NS	0.047	2.97	1.30	2.33	0.51

There was significant effect due to phosphorus, sulphur and their Interaction on physico-chemical properties of soil except pH at (P levels) and EC at Int.(PxS levels) under different treatment combination maximum Db 1.64 g/cc, Dp 2.63 g/cc, pH 7.69, EC 0.46 dSm^{-1}, OC 0.67%, available N 382.0 $kgha^{-1}$, P 42.59 kg ha^{-1}, K 148.40 $kgha^{-1}$ and S 5.20 ppm were observed in P_0S_{40}, $P_{60}S_0$, $P_{90}S_{25}$, $P_{90}S_{25}$, $P_{90}S_{25}$, $P_{90}S_{25}$, $P_{90}S_{40}$, $P_{90}S_{40}$, and $P_{90}S_{40}$ treatment combinations respectively.

Thus revealed pre-sowing as Db 1.41 g/cc, Dp 2.47 g/cc, pH 7.40, EC 0.38 dSm^{-1}, OC 0.43%, available N 300.0 kg ha^{-1}, P 28.50 kg ha^{-1}, K 149.86 kg ha^{-1} and S 5.85 ppm, as influenced in pre-sowing change in after harvesting.

Similar results observed by **Barrow (1984), Sharpley et al. (1988), Tomar and Gautam (1996) and Selvi and Ramaswami (1989).**

Table 2: Effect of different levels of Phosphorous, Sulphur and their Interaction of nutrient uptake and yield of green – gram.

Nutrient uptake and uield						
Treatments	**Nitrogen (Kg ha^{-1})**	**Phosphorous (Kg ha^{-1})**	**Potassium (Kg ha^{-1})**	**Sulphur (mg/100g)**	**Grain yield (q ha^{-1})**	**Straw yield (Kg ha^{-1})**
P_0S_0	30.25	2.65	7.08	17.64	9.83	23.49
P_0S_{25}	60.92	6.24	7.5	19.70	10.17	37.96
P_0S_{40}	42.03	9.97	9.80	27.10	12.35	45.46
$P_{60}S_0$	56.09	15.11	16.01	18.51	11.17	38.56
$P_{60}S_{25}$	63.40	12.73	11.71	23.09	10.88	41.52
$P_{60}S_{40}$	66.42	14.96	13.01	29.18	12.45	44.66
$P_{90}S_0$	65.35	23.95	16.99	21.98	14.20	43.20
$P_{90}S_{25}$	61.46	12.4	15.60	24.04	9.91	42.66
$P_{90}S_{40}$	67.56	20.91	18.98	29.63	14.85	54.75
S.E.Pm+	1.37	0.14	0.31	0.091	0.11	2.10
C.D.P at 0.05	2.90	0.31	0.67	0.193	0.24	4.46
S.E S M+	1.37	0.14	0.31	0.091	0.11	2.10
CD S at 0.05	2.90	0.31	0.67	0.193	0.24	4.46
Int.(Px S) S.E. m+	2.37	0.25	0.54	0.15	0.19	3.64
Int.(PxS) CD at 0.05	5.04	0.54	1.16	0.33	0.42	7.72

Data presented in *table-2* revealed that the observation on nutrient uptake and yield of green-gram under different treatment combinations, maximum nutrient uptake N 67.56 Kg ha^{-1}, K 18.98 Kg ha^{-1} and S 29.63 mg/100g were observed in P_{90} S_{40} treatment and maximum P uptake 2.95 kg ha^{-1} were found in P_{90} S_0 treatment when ever maximum

yield (grain and straw) 14.85 qha^{-1} and 54.75 q ha^{-1} respectively in $P_{90}S_{40}$ treatment. Similar results were ascribed by **Patra et al. (1997) Nandi and Mandal (1977), Singh and Dhar (1986), Singh and Tomar (1991) and Alimasood (1991)**.

SUMMARY AND CONCLUSION

There was remarkable effect on nutrient uptake and yield of green-gram under different treatment combination. All these treatments effect on soil properties (Physico-chemical) mostly significantly except pH at (P levels) and EC at Int. (PxS) to be proved presowing change after harvesting.

From the above results and their basis it may be concluded that high level of phosphorous (90 kg ha^{-1}), sulphur (40 kg ha^{-1}) and their Int (PxS) would not only maintain soil properties but also enhance judicious uptake of nutrients and superior acquisition of yield.

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Influence of Phosphorus and Sulphur on Oil Content and Fatty Acid Profile of groundnut (*Arachis hypogaea* L.)

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ABSTRACT

A field trial was conducted to assess the effect of different sulphur and phosphorus levels on oil content and fatty acid composition of groundnut oil. Results revealed a significant increase in oil content with an increase in sulphur and phosphorus levels from 0 to 40 kg ha^{-1} and 0 to 50 kg ha^{-1}. Significant variation in fatty acid profile was also observed with different sulphur and phosphorus levels.

INTRODUCTION

India's per capita consumption of oils and fat is continuously increasing. India has witnessed a dramatic increase in its middle class and upper middle class both in numbers and per capita income. This has lead to an increase in demand of quality vegetable oil so that it fulfill both the palatability of traditional Indian diet and also has less effect on health matters. Several approaches are being developed by scientists to boost good quality of edible oil. Groundnut (*Arachis hypogaea* L.) is an important oilseed crop in India and its oil is mainly used for edible purpose. One of these approaches is balanced fertilizer application with special emphasis on sulphur and phosphorus application because oilseeds are very sensitive to sulphur fertilization. Groundnut seed contains about 20-25 per cent protein and 40-50 percent oil. It is highly concentrated form of feed, rich in protein and fat apart from having good amount of minerals and vitamins **(Pathak and Pathak, 1992)**. Phosphorus is essential for photosynthesis, respiration, nitrogen metabolism, carbohydrate metabolism and fatty acid biosynthesis **(Rao and Singh, 1985)**. Sulphur is constituent of sulphur containing amino acids. Oil seed crops in generally have high sulphur requirement because of oil storage organs are quite rich in proteins. Sulphur can improve crop quality in several ways such as increasing the oil content and synthesis of sulphur containing amino acids and protein percentage **(Chopra and Kanwar 1966)**. Considering the importance of sulphur and phosphorus, an attempt made to study its influence on oil content and fatty acid profile of groundnut.

MATERIALS AND METHODS

The experiment was conducted on the students instructional farm of N.D.University of Agriculture & Technology, Kumarganj during kharif season 2001-2002. Four levels of sulphur (0, 20, 30 and 40 kg ha^{-1}) and four levels of phosphorus (0, 30, 40 and 50 kg ha^{-1}) were applied to assess the effect of both fertilizers on oil content and fatty acid composition compared with control. Bold and healthy seeds of G201 (Kausal) weighted 10g were kept is an oven at 70^0C for removal of moisture. The moisture free seeds were used for oil extraction according to the conventional soxhlet method **(AOAC, 1970)**.

Fatty acid composition of groundnut oil was determined by "Gas liquid chromatography" after preparing methyl esters at Central Drug Research Institute, Lucknow (U.P.)

RESULT AND DISCUSSION

The data obtained for oil content and fatty acid composition of groundnut oil as influenced by phosphorus and sulphur fertilization has been presented in *Table-1*. A significant increase was noticed in oil content with increase in sulphur and phosphorus doses. Maximum oil content (49.72%) was observed when sulphur was applied @ 40 kg ha^{-1} and phosphorus was applied @ 50 kg ha^{-1} and it was statistically superior over all the treatments. The minimum oil content (40.17 %) was recorded under controlled treatment.

The increase in oil content with sulphur application was due to conversion of carbohydrate into fat **(Singh and Abidi, 1991)**. Nitrogen and sulphur both are vital structural elements and specially needed for protein and fat synthesis. Due to sulphur nutrition, a favourable environment was created for production of metabolites responsible for oil biosynthesis in plants **(Ramnathan and Ramnathan, 1982)**. Enhancement of oil content with increasing level, of sulphur may be due to utilization of sulphur in electron transport system **(Ramnathan and Ramnathan 1982)**. **Richnold (1973)** reported that sulphur affects the quantity and quality of groundnut oil. Palmitic acid content ranged from 11.86 to 13.37 percent. Maximum palmitic acid content (13.37%) was observed in the treatment where sulphur and phosphorus were applied @ 40 kg + 50 kg ha^{-1}. Minimum palmitic acid (11.86%) was observed in control plot. Fatty acid composition of groundnut oil was also affected by location as reported by **Mathur and Sharma (1989)**.

Table 1: Oil content and fatty acid profile of groundnut (Arachis hypogaea L.) as influenced by sulphur and phosphorus application.

Treatments content	Oil acid (%)	Palmitic acid (%)	Stearic acid (%)	Arachidic acid (%)	Oleic acid (%)	Linoleic acid (%)
S_0P_0	40.17	11.86	2.65	1.23	46.06	33.72
S_0P_1	40.20	12.27	2.70	1.26	46.16	34.13
S_0P_2	40.99	12.65	2.76	1.29	46.57	34.51
S_0P_3	41.49	12.83	2.78	1.29	47.10	34.70
S_1P_0	41.60	12.17	2.68	1.25	46.36	33.99
S_1P_1	42.55	12.57	2.73	1.28	46.87	34.48
S_1P_2	43.58	12.93	2.78	1.31	47.38	34.87
S_1P_3	43.30	13.14	2.80	1.32	47.57	35.06
S_2P_0	42.18	12.46	2.71	1.27	46.68	34.21
S_2P_1	44.21	12.84	2.77	1.30	47.19	34.62
S_2P_2	45.29	13.20	2.83	1.33	47.68	34.98
S_2P_3	46.11	13.37	2.86	1.35	47.89	35.17
S_3P_0	43.31	12.60	2.72	1.29	46.87	34.42
S_3P_1	45.26	12.70	2.75	1.31	46.98	34.60
S_3P_2	46.68	12.78	2.78	1.33	47.10	34.80
S_3P_3	49.72	12.85	2.79	1.37	47.18	34.92
CD at 5% level of significance	0.94	0.37	0.21	0.15	0.31	0.42

S_0 - 0 kg ha^{-1}
S_1 - 20 kg ha^{-1}
S_2 - 30 kg ha^{-1}
S_3 - 40 kg ha^{-1}

P_0 - 0 kg ha^{-1}
P_1 - 30 kg ha^{-1}
P_2 - 40 kg ha^{-1}
P_3 - 50 kg ha^{-1}

Stearic acid content ranged from 2.65-2.86 per cent. Maximum stearic acid (2.86%) was observed in the treatment S3P3 where both fertilizers were applied at the highest rate (sulphur 40kg ha^{-1}, phosphorus 50 kg ha^{-1}). Fertilizer affects the quality of oil. **Pathak and Pathak (1972)** reported that maximum oil was synthesized under the influence of calcium sulphate and sulphur treatment. Arachidic acid, which is mainly found in groundnut seed also get affected due to fertilizer doses. Arachidic acid ranged from 1.23-1.37 per cent. Maximum arachidic acid content (1.37%) was observed in the treatment S_3P_3. The results are inconformity with findings of **Nagraj (1986)** and **Shekhan *et al*. (1980)**.

Oleic acid content ranged from 46.06 to 47.89 percent. Highest oleic acid was observed (47.89%) in the treatment S2 P_3 followed by S_3 P_3 and S_3P_0. Minimum oleic acid was noticed (46.06%) in control plot. This may be due to the fact that acetate available in seeds get converted into fatty acids having 18 carbon atom in protoplast of oilseed endosperm leading to increase in oleic, linoleic and linolenic acid content and decrease in palmitic acid as reported by **Bowley and Black (1979)**.

Linoleic acid content ranged from 33.72-35.17 percent. Maximum value (35.17%) was noticed in the treatment S_2P_3 followed by other treatments. Linoleic acid which is also known as vitamin 'F' has got its importance in nutrition of human beings. Sulphur and phosphorus interaction affects the yield and quality of produce in oilseeds and specially its fatty acid profile. Our results were inconfirmation to **Nagraj *et al*., (1990)** and **Abidi and Singh (1988)**.

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Studies on the effect of Stabilizing Agents in Guava ready to serve (RTS) Drink During Storage

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ABSTRACT

Two stabilizing agents *viz* carboxymethyl cellulose (@ 0.25, 0.50 and 0.75%) and Gum acacia (@ 0.25, 0.50 and 0.75%) were used in the study to optimize the concentration, to observe the effect on the quality parameters as well as organoleptic evaluation of the guava Ready To Serve (RTS) beverage during three months of storage. A little influence was noted in TSS content and acidity of beverages. The ascorbic acid content decreased during storage and there was an increase in reducing sugar due to the increasing concentrations of stabilizers and storage for longer periods. Organoleptic properties of beverages during 90 days of storage and carboxylmethyl cellulose @ 0.25% was found acceptable due to its colour, flavour, taste and body, thereafter the beverage treated @ 0.25% of Gum acacia. Non- enzymatic browning in the beverage increased with prolonged storage periods. It is concluded that increasing concentration of stabilizing agents and prolongation of storage decreased the acceptability of beverages.

INTRODUCTION

India is one of the important fruit producing country of the world and ranks second with a total fruit production of 45 million tones **(National Horticulture Board, 2004)**. Fruit beverages are becoming increasingly popular in comparison to the synthetic drinks evidently, because of their taste, flavour and nutritive value **(Anonymous, 1998)**. The conventionally produced products of guava include jelly, jam, pulp, concentrate, juice, cheese, toffee, dehydrated and canned guava; however guava RTS drink is one of the most important products even among different guava beverages. It has good aroma and pleasant taste besides containing good nutritional components. However, problems of browning during storage and grittiness affect its marketability. Due to fast sedimentation of guava particles during storage, the drinks turn watery in appearance. Use of some stabilizers and food emulsifiers improve the appearance of guava RTS drinks. Gums have wide range of functions including stabilizers, thickeners and structure forming agent **(Andres, 1975)**. Carboxymethyl cellulose is used as thickener, suspending

agent and film former and is also added to modify the products' properties **(Hegenbart, 1993)**. Guava RTS undergoes biochemical changes during storage. Storage increases TSS **(Pandey and Singh, 1999)**, total acidity **(Agrahari and Khurdiya, 2003)**, reducing sugar **(Tiwari, 2000)** and decreases ascorbic acid **(Deka *et al*., 2002)** content of RTS beverages. The present study was undertaken to find out the variation in different quality parameters of guava RTS during storage and to optimize the concentration of stabilizing agents in the beverage.

MATERIALS AND METHODS

The edible ripe fruits of guava *cv*. Allahabad Safeda were procured from the experimental farm of CISH, Rehmankhera, Lucknow. The diseased and damaged fruits were sorted out and sound healthy fruits were washed with tap water. Fruits were cut into small pieces and homogenized with water in a pulper. The pulp was strained through a sieve to remove the seeds. The pulp with its biochemical composition mentioned in *table-1* was heated to 78 ^{o}C and cooled down to 40-45 ^{o}C temperature. SO_2 (500 ppm) as potassium metabisulphite, dissolved separately in a little volume of water, was mixed with pulp and stored under ambient temperature (18-35^{0}C). The guava ready to serve (RTS) beverage was prepared having 10% pulp, 14% sugar and 0.25% citric acid and treated with carboxymethyl cellulose (@ 0.25%, 0.50% and 0.75%) and Gum acacia (@ 0.25%, 0.50% and 0.75%) as stabilizing agents to check the sedimentation in guava RTS drink during storage. Each treatment was replicated thrice. The pulp / beverages were analyzed for various quality parameters *viz*., titrable acidity by the method reported

Table 1 :- Biochemical composition of guava pulp cv. Allahabad Safeda.

Constituent	Quantity
TSS (^{0}B)	7.8
Acidity (%)	0.13
Ascorbic acid (mg/100g)	113.4
Reducing sugar (%)	3.95
Alcohol insoluble solids (%)	3.26
Pectin (g/100g of AIS)	19.11
Water soluble pectin (% AIS)	56.3
Ammonium oxalate soluble pectin (% AIS)	11.7
Alkali soluble pectin (% AIS)	32.0

by **Ranganna (1986)**, ascorbic acid **(Harris and Ray, 1935)**, reducing sugar **(A.O.A.C., 1970)**, pectin **(Rouse and Atkin, 1995)** and non-enzymatic browning by the method as reported by **Ranganna (1986)** at 0, 30, 60 and 90 days of storage periods.

RESULTS AND DISCUSSION

Data *(table-2)* on total soluble solids (TSS) content of guava RTS beverage show considerable differences due to treatments as well as during storage periods. TSS ranged from 14.2 to 15.0 ^{O}B during 90 days of storage. The increase was noticed maximum in almost all treatments at 90 days of storage. Gum acacia was found more influencing in TSS during storage over carboxymethyl cellulose (CMC) treatments. The results are in concordant with the findings of **Pandey and Singh (1999)** who reported that TSS content was increased in guava RTS beverage during storage. However, no change was observed in TSS content either due to treatments or storage at 30 and 60 days. The increase in TSS may be due to hemi cellulose break drown in smaller units. The augment in the amount of total soluble solids is in conformity with the findings of **Deka *et al*. (2002)** in lime aonla and mango- pineapple spiced RTS beverages. Data presented in *table-2* reveals that there is no influencing effect either of the treatments or storing periods on the acidity of guava RTS beverage. No change in acidity level was found up to 90 days of storage. However, acidity percentage was observed to decrease slightly due to treatments of carboxymethyl cellulose (CMC) up to 0.75%, gum acacia to 0.25% and storage of beverage till 90 days. Administration of 0.50% and 0.75% gum acacia stabilized the acidity level till 90 days of storage as observed in control. The

Table-2 :- Changes in TSS and Titrable Acidity of Guava RTS Beverage during Storage.

Treatments	**Total soluble solids in ^{0}B**				**Acidity (%)**			
	Storage periods (Days)				**Storage periods (Days)**			
	0	30	60	90	0	30	60	90
Control	14.4	14.2	14.2	14.6	0.22	0.22	0.22	0.22
0.25% CMC	14.4	14.2	14.2	14.4	0.22	0.19	0.19	0.19
0.50% CMC	14.4	14.4	14.4	14.6	0.22	0.19	0.19	0.19
0.75% CMC	14.6	14.6	14.6	14.8	0.22	0.19	0.19	0.19
0.25% Gum acacia	14.6	14.4	14.4	14.8	0.21	0.20	0.19	0.19
0.50% Gum acacia	14.6	14.6	14.6	14.8	0.21	0.20	0.22	0.22
0.75% Gum acacia	15.0	14.8	14.8	15.0	0.22	0.20	0.22	0.22

gradual increase in acidity at higher levels of gum acacia might be due to the accelerated degradation of pectin substances **(Conn and Stump, 1976**) or due to formation of organic acids by ascorbic acids degradation **(Prasad and Malli, 2000)**. The ascorbic acid content of guava RTS beverages decreased remarkably during storage as well as the treatments with stabilizing agents *(Table-3)*. The ascorbic acid content of beverage in control reduced from 10.6- 2.3-mg/100 ml during storage till 90 days and was the maximum decrease than the other treatments. The decrease in ascorbic acid content was also observed with the increasing concentrations of CMC and gum acacia but registered least. However, drastic decrease was found during storage periods in all treated beverages and were recorded 72%, 65%, and 68% decrease at 0.25%, 0.50% and 0.75% applied CMC and 67%, 69% and 67% decrease at 0.25%, 0.50% and 0.75% gum acacia respectively after 90 days over zero day of storage. Similar findings were also reported by **Attri *et al.* (1998)** in their studies. The continuous decline in ascorbic acid content throughout the storage periods and increasing concentrations of stabilizers may possibly be due to the oxidation of ascorbic acid to dehydroascorbic acid **(Kalra and Tandon, 1985)**. The decrease in ascorbic acid content was also reported by **Tripathi *et al*. (1992)** in all blends of pineapple–guava RTS beverages during three months of storage. Results presented in the *table-3* clearly indicate that gum acacia and storage periods both have positive response on increasing the reducing sugar percentage. Application of increased concentrations of CMC resulted in reduction of reducing sugars at all stages of storage. Reducing sugars content of guava RTS beverages increased much during storage and

Table-3:-Changes in Ascorbic Acid and Reducing Sugar content of Guava RTS Beverage during Storage.

Treatments	**Ascorbic acid (mg/100ml)**				**Reducing sugar (%)**			
	Storage periods (Days)				**Storage periods (Days)**			
	0	30	60	90	0	30	60	90
Control	10.6	7.1	4.4	2.3	1.77	3.65	4.28	4.40
0.25% CMC	10.3	6.7	4.4	2.9	1.78	2.96	4.36	4.52
0.50% CMC	10.0	6.3	4.9	3.5	1.76	2.67	3.37	4.16
0.75% CMC	9.1	6.7	4.0	2.9	1.71	2.24	3.21	3.95
0.25% Gum acacia	9.3	6.3	3.8	2.9	1.84	3.38	4.21	4.27
0.50% Gum acacia	9.4	7.1	4.6	2.9	1.92	4.26	4.33	4.56
0.75% Gum acacia	8.9	6.7	4.4	2.9	2.11	3.83	4.33	4.42

the increase was from 1.77% at zero day to 4.40% in control, from 1.78% to 4.25%, 1.76% to 4.16% and 1.71% to 3.95% respectively at the respective applications of 0.25%, 0.50% and 0.75% CMC after three months of storage. The induction was also observed from 1.84% to 4.27%, 1.92 to 4.56%, and 2.11 to 4.42% in the respective 0.25%, 0.50% and 0.75% doses of gum acacia at 90 days of storage. The increase in reducing sugars could be due to the break down of sucrose to glucose and fructose or breakdown of polysaccharides into simple sugars **(Kalra and Tandon, 1985)**. Results indicate that the maximum increase in reducing sugars was recorded in the treatment at 0.25% carboxymethyl cellulose and 0.50% gum acacia. Minimum increase in reducing sugars was recorded in treatment, which was treated with 0.75% carboxymethyl cellulose. The increasing trend in reducing sugars during storage of the RTS beverages prepared from guava and papaya pulps was also reported by **Tiwari (2000)**. Data recorded on non-enzymatic browning (NEB) of various treatments of guava RTS beverages are presented in *table-4*. Beverage samples of NEB show the remarkable improvement in O.D. values due to storage periods. Treatment with all levels of CMC and gum acacia did not show the O.D. value at zero day but value increased on storing and recorded maximum at 90 days with value 0.010, 0.007, 0.040, at 0.25%, 0.50%, 0.75% CMC and 0.055, 0.030, 0.041 at 0.25%, 0.50%, 0.75% applied gum acacia respectively. Increased doses of gum acacia increased the values at 30, 60 and 90 days of storage and recorded more value than the same doses of CMC. However, maximum increase in NEB was recorded with 0.25% treated gum acacia. The increase in NEB might be due to formation of hydroxy methyl furfural **(Khurdiya and Anand, 1981)** or may be due to the reactions between nitrogenous compounds and sugars, and organic acids and sugars **(Kapoor *el al*., 1958)**. **Tiwari (2000)** reported an increase in NEB value during storage of guava-papaya (70:30) blended RTS beverage. **Kalra *at al.* in 1991** found the similar observation. Organoleptic quality determines the storage stability of a product. There are many factors that determine the storage stability. The attributes considered in the scoring were colour, flavour and taste and were assessed by a panel of 5 semi-skilled judges on 9-point Hedonic scale. In present study, the organoleptic scores were observed with mixed responses *(table-4)*. However, in the views of judges major changes due to storage periods were not brought about. Beverages were found organoleptically acceptable up to three months of storage. The application of 0.25% of CMC during storage periods caused improvement of organoleptic scores, thereafter, the scores slightly declined. **Asraf (1987)** reported the same result as reduction in organolectic quality during storage. Increase in the concentration of gum acacia till 0.50% induced the scores for storing up to 60 days. Thus, loss in organolectic quality and the storage stability of the product after certain periods is obvious. Temperature plays an important role in the formation of off flavour and discolouration (browning) and thus masking the original flavour of the product.

Table-4:- Changes in Non-Enzymatic Browning and Organoleptic Scores of Guava RTS Beverage during Storage.

Treatments	Non-enzymatic browning (O.D)				Organoleptic score (out of 9)			
	Storage periods (Days)				Storage periods (Days)			
	0	30	60	90	0	30	60	90
Control	0.000	0.000	0.016	0.020	7.6	7.8	6.9	7.6
0.25% CMC	0.000	0.000	0.008	0.010	8.6	7.8	7.5	7.7
0.50% CMC	0.000	0.000	0.004	0.007	6.0	7.1	5.3	7.1
0.75% CMC	0.000	0.000	0.038	0.040	5.4	6.0	4.2	4.6
0.25% Gum acacia	0.000	0.000	0.052	0.055	7.8	7.6	6.4	7.2
0.50% Gum acacia	0.000	0.018	0.027	0.030	8.4	7.9	7.1	5.7
0.75% Gum acacia	0.000	0.022	0.037	0.041	8.5	8.1	7.1	4.9

Singh *et al*. (1985) and **Pandey (1995)** have also reported in their studies that the organoleptic quality of guava RTS nectar and squash are acceptable up to 6 months, at room temperature.

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