The Pharma Innovation Journal 2023; 12(10): 1632-1636

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 1632-1636

www.thepharmajournal.com
Received: 06-07-2023
Accepted: 13-08-2023

Devarakonda Vishweshwara Sai
PG Scholar, Department of Vegetable Science, College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India

J Cheena
Associate Dean, College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India

A Nirmala
Assistant Professor, Department of Horticulture, College of Agriculture, PJTSAU, Rajendranagar, Hyderabad, Telangana, India

K Nirosha
Assistant Professor, Department of Vegetable Science, College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India

B Naveen Kumar
Vice Principal, Department of Horticulture Polytechnic College, Ramagirikhilla, Telangana, India

Corresponding Author:
Devarakonda Vishweshwara Sai
PG Scholar, Department of Vegetable Science, College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India

The effect of foliar application of micronutrients on the quality attributes of cabbage (*Brassica oleracea* var. *capitata* L.) under Southern zone of Telangana

Devarakonda Vishweshwara Sai, J Cheena, A Nirmala, K Nirosha and B Naveen Kumar

Abstract
The present study entitled "The Effect of Foliar application of Micronutrients on the Quality attributes of Cabbage (*Brassica oleracea* var. *capitata* L.) Under Southern zone of Telangana" was carried out during the *Rabi* season of the year 2022-2023 at PG research block, College of Horticulture, Rajendranagar, Hyderabad**.** The results revealed that among the quality attributes, maximum Chlorophyll content (2.70 mg/100 g FW), Vitamin–A (114.32 IU/100 g) and Shelf life of cabbage heads (10.25 days) at room temperature was observed in treatment combination of T_9-Zn (0.25%) +B (0.2%) + Mn (0.25%) +Mo (0.25%) which was significantly superior over rest of the treatments, whereas minimum chlorophyll content (1.80 mg/100 g FW), vitamin-A (104.43 IU/100 g), lowest shelf- life at room temperature (7.46 days) was recorded in treatment T_{11} (control). The highest Vitamin-C (51.61 mg/100 g) was recorded in treatment combination of T_{10}-Zn (0.5%) +B (0.4%) +Mn (0.5%) + Mo (0.5%) which was significantly superior over rest of the treatments, whereas minimum vitamin-C content (43.77 mg/100 g) was recorded in treatment T_{11} (control).

Keywords: Micronutrients, cabbage, vitamin-c, vitamin-a, chlorophyll content and shelf life

Introduction
Cabbage (*Brassica oleracea* var. *capitata* L.) is the most significant Cole crop. It belongs to the *Brassicaceae* family and has chromosome number 2n=18. It originated in Western Europe and the Mediterranean region. It is mostly grown in temperate region for seed production. Its cultivation, however, is successful in the world's tropical and subtropical climates. Cole crops are one of the most important winter vegetable crops grown extensively in India. They are frequently grown in a few areas of Bihar, Madhya Pradesh, Himachal Pradesh, Maharashtra States, and the Nilgiris Hills of Tamil Nadu throughout the summer. Cabbage, broccoli, brussels sprouts, cauliflower, Chinese cabbage, knol-khol, and kale is also present. Where the name "Cole" is separated, all of the group's crops are kept apart from wild cabbage, often known as "Cole warts". These two plants are both cultivated members of the genus *Brassica oleracea*, according to (Chaudhari *et al*., 2017) [2]. The vitamin A and C content of Cole crops is high, and it also has a lot of minerals including calcium, sodium, iron, phosphorus, and potash.

India is the world's third largest producer of cabbage. For the year 2021, the estimated area under cultivation in India was 423 thousand ha ('000 ha), with an annual production of 9825 million tonnes ('000MT). (Horticultural Statistics at a Glance, 2021) [6].

Cabbage head is high in nutrients as well as vitamins A, B, and C. Half a cup of boiled cabbage is estimated to contain one-third of the vitamin C we need for the day. Additionally, it offers dietary fibre, folic acid, potassium, magnesium, vitamin K, and other nutrients. When cabbage ferments, it produces natural probiotics, which feed the bacteria in your digestive tract. These bacteria aid your body's ability to fight pathogens, absorb nutrients, digest food, and manage anxiety. Cabbage is high in vitamin C, potassium, and calcium (Hasan & Solaiman, 2012) [5]. It has a cooling effect and aids in the prevention of constipation, increasing appetite, speeding up digestion, and is especially beneficial to diabetic people (Yadav, 2000) [15]. According to reports, 100 g of cabbage's green edible portion contains 92% water, 18 mg of sodium, 170 mg of potassium, 1.28 g of protein, 5.8 g of carbohydrates, 4% calcium, 2% iron, 400 IU of vitamin A, 27 IU of vitamin B_2, and 100 mg of vitamin C.

According to reports from (Jany *et al*., 2008) [7], the usage of micronutrients aids in enhancing the translocation of carbohydrates from the site of synthesis to the storage organ and also contributes to improving cabbage growth, yield and quality. For adequate plant nutrition, micronutrients are crucial since they are used in lesser amounts than other essential elements. Lack of these essential nutrients can severely reduce crop yield and even have an impact on specific micronutrients in various physiological, morphological, and biochemical features of Cole crops. Nowadays, it is recognized that applying micronutrient foliar sprays (Fe, Zn, Mn, B, and Mo) has been successful in increasing cabbage's yield, quality, and shelf life (Kotecha *et al*., 2011) [9]. One of the simplest and most efficient ways to provide plants with enough nutrition is by foliar spray of micronutrients.

Zinc affects plant metabolism by influencing the activities of hydrogenase and carbonic anhydrase, as well as the stability of ribosomal functioning and the synthesis of cytochrome.

Boron is an essential micronutrient for regular plant growth and development. Manganese is essential for photosynthesis since the photosystem-II water oxidizing system requires an absolute amount of manganese (Hakala *et al*., 2006) [4].

Molybdenum is a crucial component of two enzymes that convert nitrate into nitrite, a dangerous form of nitrogen, and then into ammonia, which is then used inside the plant to produce amino acids.

Materials and Methods

The present study was conducted at PG Research Block, College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad, during *Rabi* season for the year 2022-23. The experiment was laid out in Randomized Block Design (RBD) with Eleven treatments and three replications i.e., T_1- Zn 0.25%, T_2- Zn 0.5%, T_3- B 0.2%, T_4- B 0.4%, T_5- Mn 0.25%, T_6- Mn 0.5%, T_7- Mo 0.25%, T_8- Mo 0.5%, T_9- Zn (0.25%) +B (0.2%) + Mn (0.25%) +Mo (0.25%), T_{10}- Zn (0.5%) +B (0.4%) +Mn (0.5%) + Mo (0.5%), T_{11}- Control. The Foliar Spray was applied at 30,45,60 days after transplanting. The standard recommended package of practices of SKLTSHU was followed to raise the successful crop. Periodical observation was recorded for Vitamin-C, Vitamin-A, Chlorophyll content and Shelf life. The data for these parameters were significantly analyzed in ANOVA are presented in Table 1. The standard procedures for estimation of the quality parameters are as followed.

1. Chlorophyll content (mg/cm^2)

The chlorophyll content was estimated according to the method of Arnon (1949) [1]. Leaves were randomly collected and washed thoroughly with distilled water. Leaf tissue 100 mg was suspended in 10 ml of 80% acetone, mixed well and kept at 4 ºC overnight in dark. The extract was filtered through Whatman filter paper no.1 and the final volume was made 25 ml with acetone. The filtrate was utilized for estimation of total chlorophyll by measuring its optical density at 645 and 663 nm wavelengths respectively with a blank of 80% acetone on a UV visible spectrophotometer. The following formula was employed for estimation of total chlorophyll in curd sample.

$$\text{Total Chlorophyll (gl}^{-1}) = 0.0202\ A_{663} + 0.00802\ A_{645}$$

2. Vitamin - A content (IU/100 g)

Vitamin - A was estimated by using chloroform, Diethyl ether, Antimony trichloride solution from five selected observational plants and the amount of vitamin - A was estimated and expressed in (IU/100 g) by using formula:

$$\text{U.S.P. unit ml}^{-1} = \frac{A}{B\text{-}A} \text{ x concentration of Vit-A standard (U.S.P. unit ml}^{-1}).$$

3. Vitamin - C content (mg/100 g)

Ascorbic acid was determined by titrating a known weight of sample with 2,4,6 dichloro-indophenol dye using metaphosphoric acid as stabilizing agent as described by Ranganna (1979) [12]. Known weight of the sample was ground in pestle and mortar with 3% Meta phosphoric acid. Volume was made up to 100 ml and filtered. 10 ml of aliquot was titrated against 2,4,6 dichloro-indophenol dye. The dye factor was calculated by titrating standard ascorbic acid solution against dye and ascorbic acid content of sample and it was expressed in (mg/100 g).

$$\text{Ascorbic acid} = \frac{\text{Titrate value x Dye factor x Volume made up}}{\text{Weight of the sample x Aliquot of sample}} \text{ x } 100$$

4. Shelf life (Days)

Shelf life was determined by computing the days how long the heads remain in good condition and the total number of days for which the heads remain in good condition that period was recorded as shelf life for particular treatment.

Results and Discussion

The Present investigation on "The Effect of Foliar application of Micronutrients on the Quality attributes of Cabbage (*Brassica oleracea* var. *capitata* L.*)* under Southern zone of Telangana" during *Rabi* season 2022-23 are discussed and presented below (Table 1.).

1. Chlorophyll content (mg/100 g FW)

The data on influence of micronutrients on chlorophyll content are presented in the Table 1 and Fig 1.

During the results, maximum chlorophyll content (2.70 mg/100 g fresh weight) was observed with the application of T_9-Zn (0.25%) +B (0.2%) + Mn (0.25%) +Mo (0.25%) which was significantly on par with treatment T_{10}-Zn (0.5%) +B (0.4%) +Mn (0.5%) + Mo (0.5%) is (2.60 mg/100 g fresh weight), T_2 -Zn (0.5%) is (2.53 mg/100 g fresh weight). Whereas, treatment T_{11}-(control) exhibited minimum chlorophyll content of 1.80 mg/100 g fresh weight.

The availability of molybdenum and boron, which support the plant growth hormone and enzyme system and are therefore necessary for chlorophyll formation, may be the cause of the increase in chlorophyll content values. Iron also serves as an oxygen carrier and is involved in cell division and growth, both of which may have facilitated chlorophyll formation. This could be explained by the exogenous application of micronutrients increasing the area available for photosynthesis and increasing the accumulation of carbohydrates, which has a direct impact on protein synthesis. A similar result was also reported by Kotecha *et al*. (2016b) [10] in cabbage., Choudhary *et al*. (2018) [3] in Knol-khol and Singh *et al*. (2019) [14] in broccoli.

2. Vitamin - A content (IU/100 g)

Retinol content (Vitamin A) is a key component of cabbage that enhances the head's nutritional value. The data on influence of micronutrients on Vitamin-A content are presented in the Table 1 and Fig 2.

During the results, maximum vitamin-A (114.32 IU/100 g) was observed with the application of T_9-Zn (0.25%) +B (0.2%) + Mn (0.25%) +Mo (0.25%) which was statistically on par with treatment T_{10}-Zn (0.5%) +B (0.4%) +Mn (0.5%) + Mo (0.5%) is (113.24 IU/100 g) and T_2-Zn (0.5%) is (111.69 IU/100 g), whereas, treatment T_{11}-(control) exhibited minimum vitamin-A content (104.43 IU/100 g).

Increase in the carotene content might be due to various enzymatic activities of the plant due to the application of boron and molybdenum. This could be attributed due to high carotenoids role in coordinating with various plastid isoprenoid pigments to control plant growth and development. Thylakoid membranes and plastoglobuli in chloroplasts gave the plastids a strong capacity to retain and store the produced carotenoids, causing a high level of carotenoid accumulation in green tissues increased the amount of carotene in the head of cabbage. The results are in confirmation with Kotecha *et al.* (2016b) [10] in cabbage.

3. Vitamin - C content (mg/100 g)

One of the key quality components in of cabbage is ascorbic acid content (Vitamin C), which enhances the nutritional value of head. The data in Table 1 and Fig 3 reported that micronutrients had a substantial impact on the amount of vitamin C (mg/100 g) in cabbage during study.

The results revealed that, the significantly maximum ascorbic acid content (51.61mg/100 g) was recorded in treatment T_{10} - Zn (0.5%) +B (0.4%) +Mn (0.5%) + Mo (0.5%) and it was statistically at par with treatment T_9 and T_2 whereas minimum ascorbic acid content (43.77 mg/100 g) was observed in treatment T_{11}-(control).

The use of boron and molybdenum, which function as active carriers for a variety of enzymatic activities and enzymes that catalyze a wide variety of biochemical processes, such as those that counteract the effects of reactive oxygen species and several plant ascorbate production pathways that increase the ascorbic acid content of cabbage heads. The similar results were also reported by Kotecha *et al.* (2011) [9] in cabbage, Moklikar *et al.* (2018) [11] in cauliflower.

4. Shelf life (Days)

The data regarding shelf life of cabbage heads influenced due to different treatments of micronutrients are represented in Table 1 and Fig 4 indicated that, there were significant variations in the shelf life of cabbage among the different treatments of micronutrients.

The maximum shelf life of cabbage heads (10.25 days) at room temperature was observed in treatment of Zn (0.25%) +B (0.2%) + Mn (0.25%) +Mo (0.25%) and it was statistically on par with treatment T_{10} and T_1, T_2, T_4 under room temperature. Whereas, minimum shelf life of cabbage heads (7.46 days) at room temperature was recorded in treatment T_{11}-(control). Enhanced shelf life of cabbage heads may be due to less moisture loss through these heads produced with the application of this treatment. The enhanced shelf life of cabbage heads may be due to micronutrients to improve the quality of harvested produce. The similar outcomes were also reported by Sarma *et al.* (2005) [13] and Kanujia *et al.* (2006) [8] in cabbage, which support current findings.

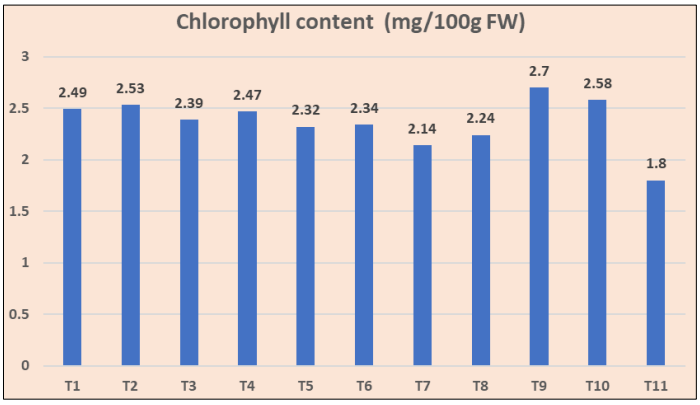

Fig 1: Effect of foliar application of micronutrients on Chlorophyll content (mg/100 g FW) of cabbage

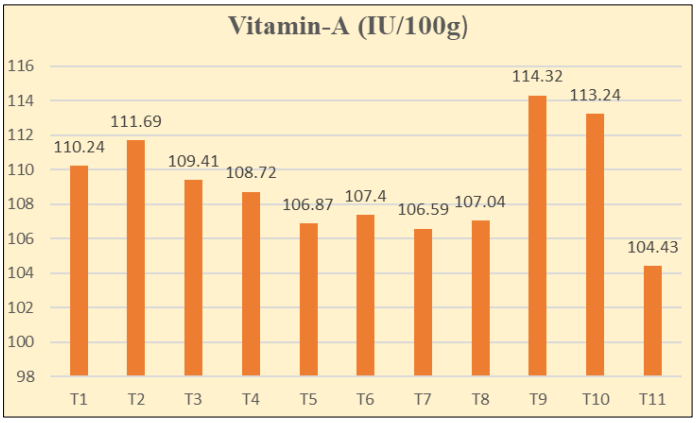

Fig 2: Effect of foliar application of micronutrients on Vitamin-A(IU/100 g) of cabbage

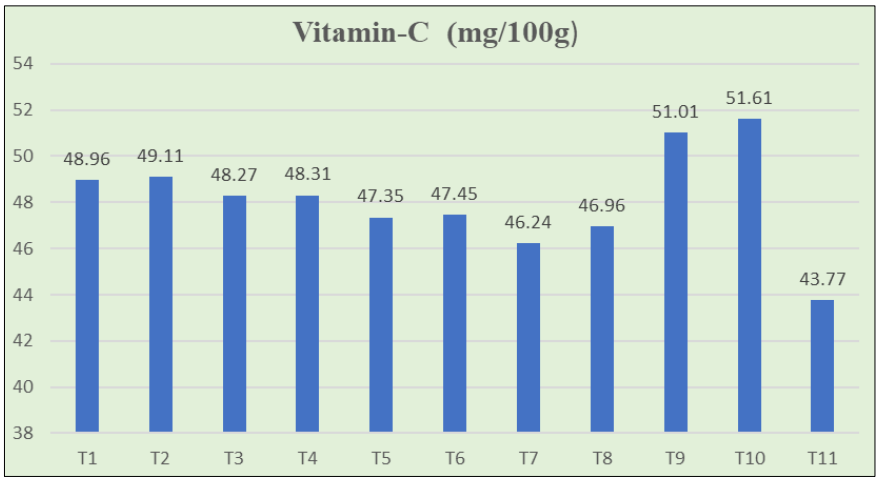

Fig 3: Effect of foliar application of micronutrients on Vitamin-C (mg/100 g) of cabbage

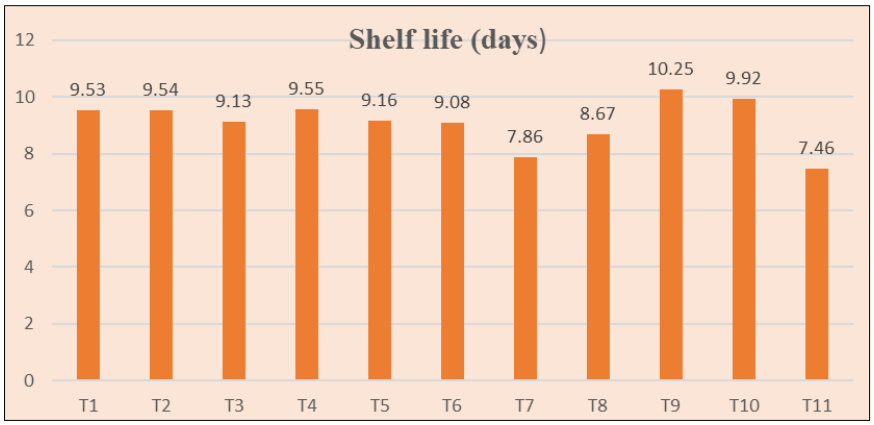

Fig 4: Effect of foliar application of micronutrients on Shelf life(days) of cabbage

Table 1: Effect of foliar application of micronutrients on Quality Attributes in Cabbage

Treatments	Micronutrient and it's concentration	Chlorophyll content (mg/100 g FW)	Vitamin-A (IU/100 g)	Vitamin-C (mg/100 g)	Shelf life (days)
T_1	Zn 0.25%	2.49	110.24	48.96	9.53
T_2	Zn 0.5%	2.53	111.69	49.11	9.54
T_3	B 0.2%	2.39	109.41	48.27	9.13
T_4	B 0.4%	2.47	108.72	48.31	9.55
T_5	Mn 0.25%	2.32	106.87	47.35	9.16
T_6	Mn 0.5%	2.34	107.40	47.45	9.08
T_7	Mo 0.25%	2.14	106.59	46.24	7.86
T_8	Mo 0.5%	2.24	107.04	46.96	8.67
T_9	Zn (0.25%) +B (0.2%) + Mn (0.25%) +Mo (0.25%)	2.70	114.32	51.01	10.25
T_{10}	Zn (0.5%) +B (0.4%) +Mn (0.5%) + Mo (0.5%)	2.58	113.24	51.61	9.92
T_{11}	Control	1.80	104.43	43.77	7.46
SEm+		0.06	0.92	0.86	0.23
CD at (5%)		0.19	2.74	2.55	0.69

Conclusion

The maximum chlorophyll content (2.70 mg/100 g FW), maximum vitamin –A (114.32 IU/100 g) and maximum shelf-life at room temperature (10.25 days) was recorded in treatment combination of T_9 - Zn (0.25%) +B (0.2%) + Mn (0.25%) +Mo (0.25%). However, minimum chlorophyll content (1.80 mg/100 g FW), vitamin-A (104.43 IU/100 g) and lowest shelf- life at room temperature (7.46 days) was recorded in T_{11} (control). whereas, the maximum vitamin-C (51.61 mg/100 g) was recorded in treatment of T_{10}-Zn (0.5%) +B (0.4%) +Mn (0.5%) + Mo (0.5%). Minimum vitamin-C content (43.77 mg/100 g) was recorded in T_{11} (control).

Among all the treatments, application of T_9-Zn (0.25%) +B (0.2%) + Mn (0.25%) +Mo (0.25%) was proved the best treatment in quality of cabbage as compared to rest of the treatments.

References

1. Arnon DI. Copper enzymes in isolated chloroplast, polyphenol oxidase in *Beta vulgaris.* Plant Physiology. 1949;24(2):1-15.
2. Chaudhari VL, Patel NK, Patel GD, Chaudhari VJ, Sheth SG. Impact of micronutrients spray on growth and yield of *Brassica oleracea* var. *capitata.* International Journal of Chemical Studies. 2017;5(4):2113-2115.
3. Chaudhari VL, Patel NK, Patel GD, Chaudhary VJ,

Nayak SR. Effect of foliar spray of micronutrients on yield of cabbage (*Brassica oleracea* var. *capitata* L.). International Journal of Chemical Studies. 2018;6(3):1724-26.
4. Hakala C, Verma H, Hanit H. Micronutrient application and their effects on vegetable crops. Journal. of Agriculture. Technology. 2006;43(2):114-120.
5. Hasan MR, Solaiman AHM. Efficacy of organic and inorganic fertilizer on the growth of cabbage. International Journal of Agriculture and Crop Sciences. 2012;4(3):128-138.
6. Horticultural Statistics at a Glance. Government of India. Ministry of Agriculture and Farmers Welfare; c2021.
7. Jany MN, Sarker C, Mazumdar MA, Shikder MF. Effect of storage conditions on quality and shelf life of selected winter vegetables. Journal of Bangladesh Agricultural University. 2008;6(2):391-400.
8. Kanujia SP, Ahmed N, Chato MA, Jabeen N, Narayan S. Effect of micronutrients on growth and yield of cabbage. Indian Journal of Horticulture. 2006;8(1):15-18.
9. Kotecha AV, Dhruve JJ, Vohol NJ. Effect of foliar application of micronutrients and growth regulators on growth and yield of cabbage (*Brassica oleracea* L. var. *capitata*) cv. Golden Acre. Asian Journal of Horticulture, 2011;6(2):381-384.
10. Kotecha AV, Patel J, Dhruve JJ. Influence of micronutrients and growth regulators on shelf life of cabbage. International Journal of Current Microbiology and Applied Sciences. 2016b;5(7):329-36.
11. Moklikar MS, Waskar DP, Maind MM, Bahiram VK. Studies on Effect of micro nutrients on Growth and Yield of Cauliflower (*Brassica oleracea* var. *botrytis*) cv. Sungro-Anandi. International Journal of Current Microbiology and Applied Sciences; c2018. p. 2351-2358.
12. Ranganna S. Manual of analysis of fruit and vegetable products. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi; c1979. p. 94.
13. Sarma P, Goswami RK, Deka BC. Effect of foliar application of micronutrients on shelf life of cabbage. Indian Journal of Horticulture. 2005;62(2):160- 62.
14. Singh G, Sarvanan S, Rajawat KS, Rathore JS, Singh G. Effect of Different Micronutrients on Plant Growth, Yield and Flower Bud Quality of Broccoli (*Brassica oleracea* var. *italica*). Current Agriculture Research Journal; c2019. ISSN: 2347-4688, Online ISSN: 2321–9971.
15. Yadav RL. Response of onion (*Allium cepa* L.) cultivars to nitrogen and potassium fertilizer under semi-arid conditions of Rajasthan. Ph.D. Thesis, submitted to Rajasthan Agricultural University, Bikaner; c2000.