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CHEMICO-QUALITY TRAITS OF THREE LENTI~'CULTIVARS AS INFLUENCED BY FOLIAR APPLICATION OF CALCIUM-CUM-MAGNESIUM

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Effect of foliar application of calciurn-curn-rnagnesium in different concentrations (0, 100, 200, 300 mol m"3) on the chemical composition and quality traits of seed of three lentil cultivars viz. Masoor-local, Masoor-85 and Masoor-93 was studied under field on a sandy-clay loam soil for two years. Seed protein concentration was significantly maximum (24.98%) in Masoor-93 while P, K, Ca, Mg and phytic acid content of the seed did not vary significantly among the three cultivars. Cooking quality score was also the lowest in Masoor-93 indicating its cooking quality superior to other two cultivars. By contrast, foliar application of Cat- Mg @ 200 mol m"3 significantly improved the phytic acid content of the seed and its cooking quality over control but seed protein concentration and P, K. Ca and Mg contents were not affected to a significant level.

Key words: Chernico-quality traits, lentil cultivars, foliar application. calcium, magnesium.

INTRODIJCTION

The soils of many lentil growing areas in Pakistan are not only low in phosphorus (P) but also are deficient in other essential nutrients and thus respond positively to P application (Sharar *et al.*, 1976). Phosphorus application to lentil is considered to improve both the yield and quality of the crop through its effect on root development and nodulation.

Calcium and Mg also affect the yield and quality of the crops. Calcium is taken up only by the young root tips having unsuberized cell walls of the endodermis (Tisdale *et al., 1990).* Though the quantity of Ca and Mg are sufficient in our soil yet their absorption by plant roots is very low. Thus Ca deficiency may occur in rapidly growing crops even with its ample supply in the soil (Simpson, 1974). So the foliar application of Ca and Mg at flowering stage of lentil crop may increase the yield and quality of lentil seeds.

Contrary to cereals. lentil seed is high in lysine and low in methionine. The' use of lentil in combination with cereals provides all the essential amino acids by compensating the deficiency of various amino acids in one or another. Lentil in Pakistan is used after cooking as whole or in split form in combination with rice or wheat bread. The cooking time for different cultivars of lentil is not uniform due to differential genetic make up and nutrients availability during crop growth and development. Some of them cook fast, some late and even some do not cook at all. The cooking quality of lentil is very important as fast cooking lentils fetch higher prices in the market.

The cookability of lentil seed is correlated to pectin, phytin, Ca and Mg contents (Muller, 1967). Phytic acid content has a positive correlation with the cooking time of lentil seed (Shah and Abu-Shakra, 1982). Since nutrition affects the chemical composition and cooking quality so application of P and Ca and Mg to lentil may improve the cooking quality of lentil seed. With this in view a study was undertaken to evaluate the effect of foliar application of calcium and Mg in different concentrations on chemical composition and cooking quality of three lentil cultivars under the agro-climatic conditions of Faisalabad.

MATERIALS AND METHODS

The experiment was conducted for two years on a sandy-clay loam soil at the University of Agriculture, Faisalabad during 1997-98 and 1998-99. The cultivars tested were Masoor-local, Masoor-85 and Masoor-93. Calcium nitrate and Mg sulphate in I: I mol ratio in 0, 100, 200 and 300 mol m"3 concentrations were sprayed at flower initiation stage of the crop. A uniform basal dose of 50:75:50 kg NPK ha" was incorporated in soil in all the treatment plots including control at sowing time. The experiment was laid out in a split plot randomized complete block design with four replications assigning cultivars to main and the spray levels to the subplots. The crop was sown in the second week of November in both the years in 25 cm apart rows in 1 x 2 m plot with single row hand drill by using a seed rate of 25 kg ha' for Masoor-93 and 20 kg ha' for Masoor-local and Masoor-85, in order to achieve uniform plant density. The crop was kept weed free throughout the growing period by hoeing and hand pulling. Two irrigations each of 7.5 cm depth were given in addition to 10 cm seedbed preparation irrigation. The crop was harvested at full maturity during second week of April every year, dried and threshed manually. Data on P. K, Ca and Mg content of the seed were recorded by using standard analytical techniques and methods as described in U.S. Salinity Laboratory Staff (1954), while phytic acid and cooking quality were evaluated by the method described by Wheeler and Ferrell (1971) and Shah and Abu-Shakra (1982), respectively. The seed protein content was determined by using the method described by Jackson (1962). The data collected were subjected to Fisher's analysis of variance technique and least significant difference (LSD) test at 0.05 P was used to compare the treatment means (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Seed protein concentration

Seed protein concentration was significantly higher in Masoor-93 (24.98%) than Masoor-local and Masoor-Sf which were at par with each other and showed a protein concentration of 22.79 and 22.93%, respectively (Table I). These results are in conformity with those of Sadiq *et al.* (1998). By contrast, the foliar application levels had non-significant effect on seed protein concentration. However, the protein concentration ranged from 23.42 to 23.69%. These results are in line with those of Klein *et al.* (1982).

Table I. Qualitative traits of three lentil cultivars as affected by foliar application of calcium + magnesium in I: I mole ratio at different concentrations.

(2-year average data)

Cultivars	Protein (%)	Calcium	Magnesium	Potassium	Phosphorus	Phytic acid	Cooking quality (score)
		Mg/IOO g					
Masoor-local	22.79 b	77,00	80.31	797.81	476.34	152,46	5.63
Masoor-85	22.93 b	81,75	80.32	781,12	468.37	145.53	595
Masoor-93	24.98 a	84.50	80,49	807.00	481.32	157,46	5,38
LSD (0.05 P)	0.44	NS	NS	NS	NS	NS	NS
Foliar application of calcium-cum-magnesium							
Control	23,42	76.67	80.16	778.42	479.75	135.46b	7.58 a
100 (mol m^{-3})	23.69	79.67	80,32	814.46	470.00	148.54 b	6.17 b
200 (mol m^{-3})	23.69	83.67	80,48	794.00	475.04	175.12 a	3.83 d
300 (mol m^{-3})	23,46	84.33	80.54	794.37	476.58	148.29 b	5.08 c
LSD (0.05)	NS	NS	NS	NS	NS	12.70	0.34

Entries not sharing a letter differ significantly at 0.05 P.

NS = Non-significant

Seed potassium content

The seed K content did not vary significantly among the cultivars. However, Masoor-93 tended to show higher seed K content (807 mg) than Masoor-85 (781.12 mg) and Masoor-local (797.81 mg). These results agree with those of Bhatty and Slinkard (1989). Similarly, the effect of Ca-cum-Mg foliar application on seed K content was non-significant and the range in variation in seed K content was from 778.42 to 814.46 mg/IOO g seed. These results are in line with those of Laughlin (1966).

Seed phosphorus content

The seed P content in all the cultivars was statistically similar and showed a range from 468.37 to 481.32 mg/100 g (Table 1). These results contradict with those of Bhatty (1989). Differences among the foliar application levels of Ca-cum-Mg were also non-significant showing a range from 470.00 to 479.75 mg/lOO g seed.

Seed calcium and magnesium content

The seed Ca and Mg content did not vary significantly among the cultivars probably because of their similar composition of the seed. However, the range of seed Ca and Mg was 77.00 to 84.50 and 80.31 to 80.49 g per 100 gram of seed, respectively among the different cultivars (Table I). These results are in line with those of Shah and Abu-Shakra (1982) and Bhatty (1984). Foliar application of Ca + Mg in different concentrations also did not affect the seed Ca and Mg contents to a significant level indicating thereby that Ca + Mg spray at final irrigation stage of the lentil crop did not play any role in changing the overall chemical composition of the seed. These results are in line with those of Laughlin (1966) for both Ca and Mg.

Seed phytic acid content

There was no significant variation among the three cultivars in respect of seed phytic acid content which on the average varied from 145.53 to 157.46 mg/100 g of seed with the maximum in Masoor-93 and the lowest in Masoor-Iocal. These results are in agreement with those of Bhatty and Slinkard (1989). By contrast, foliar application of Ca + Mg at a concentration level of 200 mol m^{-3} increased significantly the seed phytic acid content (175.12 mg/l00 g of seed) over other treatments including control. However, they were statistically at par with one another and showed a range of 135.46 to 148.54 mg of phytic acid per 100 gram of seed. It appears from the results that Ca + Mg application as spray facilitates the synthesis of phytic acid in the seed of lentil.

Seed cooking quality

Although the cooking score of seed varied from 5.38 to 5.99 among the three cultivars with the lowest (5.38) in Masoor-93 and the highest (5.99) in masoor-85 but the differences among them were statistically non-significant. As the lower the value of cooking score, the better is the cooking quality thus qualitywise Masoor-93 was at the top. Variation of seed cooking quality among the different lentil genotypes has also been reported by Bhatty and Slinkard (1989). By contrast, there was a linear decrease in the cooking quality score with each successive dose of Ca + Mg application from 100 to 200 mol m^{-3} over control with significantly the lowest (3.83) in 200 mol m" treatment against the highest (7.58) in check. The results clearly indicated the beneficial role of Ca + Mg application in improving the cooking quality of the lentil seed.

The results led to the conclusion that Masoor-93 appeared to be superior to Masoor-85 and Masoor-Iocal in respect of seed protein concentration and its cooking quality and that foliar application of Ca + Mg @ 200 mol m" at flower initiation stage caused a significant improvement in phytic acid content of lentil seed and its cooking quality.

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AGRO-ECONOMIC ADVANTAGES OF 2-FURROW DITCH IRRIGATION SYSTEM IN SUGARCANE

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Now-a-days skip furrow irrigation system is being advocated among the sugarcane growers as an efficient water saving technology by the Agriculture Department, Government of the Punjab. In our opinion, skip furrow irrigation in sugarcane during the early growing period (March to June) will not only slow down the growth rate of sugarcane seedlings/plants due to long spell of irrigation drought/stress (10 to 20 days) but also will retard the overall growth of the plants especially during the hot months (April to June) because of below normal water potential of the plants and inadequate soil moisture. Resultantly tillering potential as well as stand density per unit area will be adversely affected as a result of continuous water stress during the early growth period caused by skip furrow irrigation. Moreover skip furrow irrigation system will reduce the water-use efficiency because of slow growth rate due to long spell of water stress which will vary from 14 to 20 days under farmers' conditions of "Warabundi" system. So it will ultimately lead to false economy or saving of irrigation water which is achieved at the cost of reduced plant growth and poor stand density of the cane crop. In other words, there will be a physiological loss of irrigation water rather than saving of irrigation water as saving of irrigation water at the cost of growth potential and cane density per unit area will rather be a mismanagement of irrigation water.

By contrast a newly developed 90 cm spaced 2-furrow ditch irrigation system by the authors, is more efficient and superior to all other methods as it not only leads to substantial saving of irrigation water to the extent of 25-30 percent but also improves the yield potential by 15-20 percent and water-use efficiency to a considerable extent as a result of the followings:-

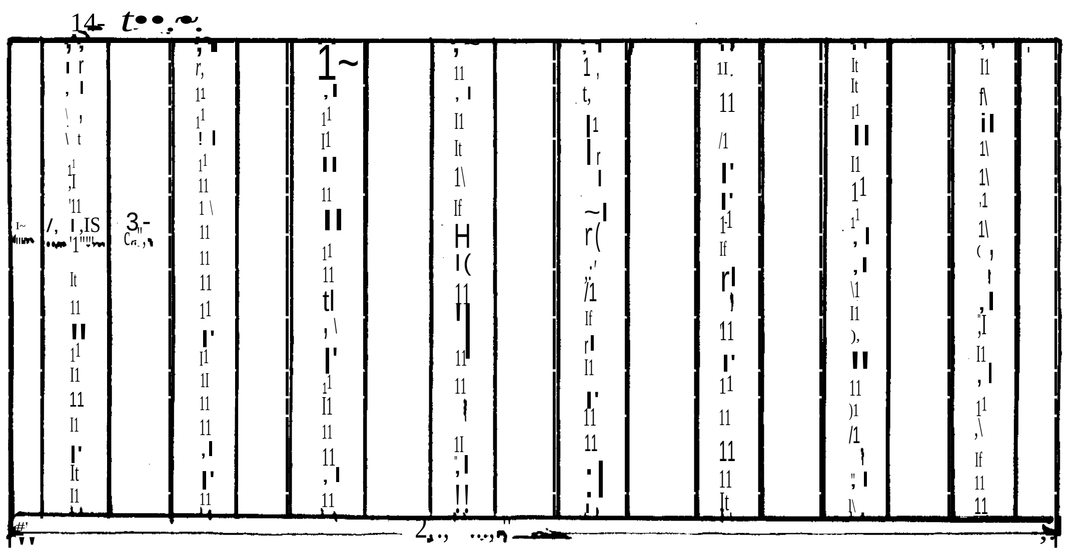
- Under 2-furrow ditch irrigation system as the number of irrigation ditches are reduced to 50 percent as compared to single furrow ditch irrigation system, so with the same quantity of irrigation water as required for skip furrow irrigation system one can easily irrigate all the ditches under 2-furrow ditch system every time and thus avoiding the water stress and improving the water-use efficiency to a considerable extent.

- Even after earthing up. the number of irrigation furrows remain 50 percent less than the single furrow irrigation systems as two cane rows are earthed up together at a time. Whereas under single furrow ditch irrigation system only one row is earthed up at a time as a result of which the number of irrigation furrows gets doubles (Fig-I) and consequently the earthing up cost and time also get increased two times more than the 2-furrow ditch system.

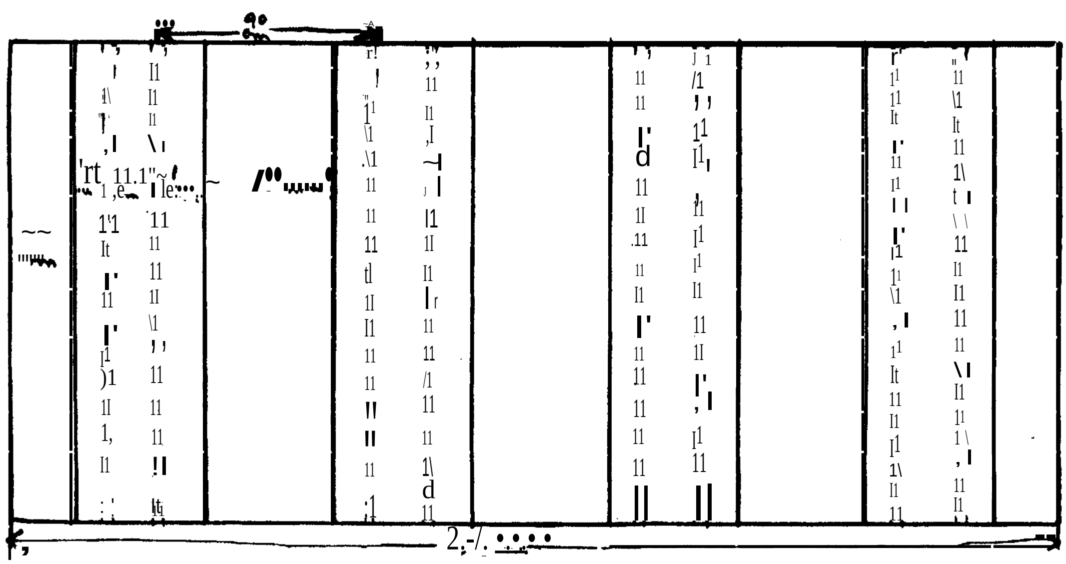
- Moreover, sugarcane planted in 2-furrow ditches or 2-row strips yields 15-20 percent higher than that planted in single furrow ditches. It would thus be more appropriate to practise 2-furrow ditch system of irrigation instead of alternate furrow irrigation system as it besides saving irrigation water also reduces the earthing up and plant protection cost and time by 50 percent.

- Two rows strip-furrow irrigation system is equally good and beneficial for maize. sunflower. cotton etc. as it merits many agro-economic advantages besides saving substantial quantity of irrigation water.

FIG-I. . PLANTATION SCHEME OF SINGLE AND T\;VO FURRO\V DI'1'('H SYSTEl\l



\. SINGLE FlIRRO\V DITCH SYSTEi\'1



B. TWO FURRO\V DITCH SYSTEM