Pak. J. Bot., 42(3): 2151-2163, 2010.

INFLUENCE OF DIFFERENT LEVELS OF POTASH ON THE QUANTITY, QUALITY AND STORAGE LIFE OF ONION BULBS

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Abstract

This experiment was conducted to study the influence of different potash doses i.e., 0, 25, 50, 75 and 100 kg ha^{-1} applied to onion cultivar Swat-1. The experimental results indicated that the significant maximum plant height, leaves $plant^{-1}$, medium size bulbs, large size bulbs, yield and bulb firmness, dry matter, pungent bulbs and TSS of bulbs were recorded with onion crop treated with 75 and 100 kg potash ha^{-1}. Sulphate of potash (SOP) fertilizer significantly produced tallest plant, firmed bulbs, dry matter, pungent bulbs, TSS of bulbs, small and medium size bulbs, as compared to muriate of potash fertilizer (MOP). There was about 76 days difference of post harvest life between cold stored and room stored bulbs. The minimum disease incidents, bulb sprouting at room temperature, bulb sprouting in cold store were recorded in 100, 75 and 50 kg K_2O ha^{-1}. The significantly highest disease incidents, large size bulbs, bulbs moisture, bulbs sprouting at room temperature, bulbs sprouting in cold store, weight loss at room temperature and weight loss in cold store were recorded with MOP. The minimum small bulbs, moisture of bulbs, bulbs sprouting at room temperature, bulbs sprouting in cold store, weight loss at room temperature, and weight loss in cold store were produced by 100 kg K_2O ha^{-1}. The behavior of the onions regarding weight loss and sprouting in both conditions were quite similar. The mean loss of weight in bulbs stored at room temperature was 47.7 %, while in cold-stored bulbs was 22.4 %. Similarly sprouting in bulbs stored at room temperature was 18.7 %, while in cold-stored bulbs was 6.6 %. It was noted that with increase of potash dozes in both sources of Potash (SOP or MOP) the decrease in weight loss and sprouting was observed. The weight loss and sprouting in SOP treated plots were lower as compared to muriate of potash.

Introduction

Onion (*Allium cepa* L.) has been used extensively to improve the taste of food and cultivated several thousand years before Christ (Ginai, 1970). Proper management techniques such as fertilizers, soil moisture and disease control, harvest time and curing enhance onion produce (Kabir, 2007). Optimization of such practices result in significant decrease in post harvest losses in onion. Decrease in post harvest losses will be instrumental in market stability and exploiting opportunities to export onion and earn foreign exchange. Best quality onion can be produced through application of well-balanced fertilizers. Research work has been done on the base of NPK in different soil types and in various climatic conditions, but very limited work has been reported on various sources of fertilizes for a certain nutrient. Among NPK, potash has been ignored by most of our local growers to apply to their crops. Though the quantity of potassium in the soil of Peshawar is adequate (Table 1) but there is also evidence of fixation of potassium in the soil (Murashkina *et al*., 2006). Therefore the application of K in the soil having fair amount of K contents will still show its effect on plants. Among the various nutrients required to produce high yield, potassium is considered to be a very important element due to its influence on translocation of photosynthates, K deficiency dramatically reduced leaf area and dry matter accumulation and affected assimilate partitioning among plant tissues (Duli Zhao *et al.*, 2001) Among different sources of potassium, Sulphate of potash (SOP) contains sulfur that may get lead in more growth and development as compared to Muriate of potash (MOP). Therefore the present experiment was carried out to investigate the effect of MOP versus SOP on the yield and post harvest quality of onions in prevailing agro climatic conditions of Peshawar valley.

Materials and Methods

The experiment was conducted at Agriculture Research Institute Tarnab, Peshawar during 2005-06. It consisted of two factors i.e., sources of potash and levels of potash. Among sources Sulfate of potash and Muriate of potash were used, while each source consisted four levels (25, 50, 75 or 100 kg K_2O hectare^{-1}). The experimental design two factorial RCB was applied in accordance with Steel & Torrie, (1980).

Seeds of Swat-1 variety of onion; one of the leading and recommended variety in NWFP Pakistan, were sown in the 2nd week of October, 2005 followed by irrigation. Seedlings were transplanted in the experimental plot on December 12, 2005 (80 days after sowing). The total experimental plot area was 37.5 m^{2,} having 1.25-m^2 area for each treatment in each replication. The plant to plant distance was 10 cm and row to row was 25 cm as recommended by Khan & Khan (1990). Soil samples were taken and analyzed for physic-chemical attributes (Table 1). The calculated amounts of Urea and Diammonium Phosphate were applied as a constant doze (at the rate of urea 100 kg ha^{-1} and DAP 196 kg ha^{-1}) during land preparation, while remaining 95 kg Urea ha^{-1} was applied 30 days after transplantation Urea total recommended doze is 195kg ha^{-1} Khan & Khan (1990). The calculated amount of MOP and SOP were applied at the time of land preparation @ 25, 50, 75 and 100 kg ha^{-1} and 0 kg potash ha^{-1} (control). Onions were harvested (on 2nd June, 2006) when more than 40% of leaves top bent down (Khan & Khan, 1990 and Khokhar & Jilani, 2000). The bulbs were placed for five days under partial shade in open for curing.

Table 1. Physico-chemical properties of the experimental site.

Characteristics	Units
Sand	65.2 %
Silt	24.0 %
Clay	10.8 %
Textural class	SANDY loam
Organic matter	1.31 %
Total nitrogen	0.065 %
Lime ($CaCO_3$)	16.25 %
pH 1:1 water	8.3
Electric conductivity (1:1)	0.34 d S m^{-1}
Total soluble solids	0.109 %
AB-DTPA extractable nutrients	
P (mg kg^{-1})	6.40
K (mg kg^{-1})	273

Soil Physico-chemical properties of the experimental site was done at Agriculture Research Institute Tarnab, Peshawar, NWFP, Pakistan

The data on number of leaves plant^{-1}, plant height, disease incidence percentage, weight of small, medium and large size bulbs ha^{-1}, yield ha^{-1}, thickness of outer most scale leaf (measured by using Vernier Caliper). As the outer most scale leaves were very thin, therefore each leaf was cut in 20 pieces, arranged them in a layer and took the data, by calculating the mean of 20 pieces, firmness of bulb by using Penetrometer model FT 011 (0-11 lbs), pungency percentage by organolaptic or taste judgment by a panel of four judges. Each judge had maximum 10 points for the pungency. A ranking table was provided to each judge, total soluble solids by using Refractometer, weight loss (using weighing balance), moisture content (by taking 10 g slices of the fleshy scales of the bulbs were weighed and placed in a glass container dish) and were heated up to 60^{o}C in the oven for 24 hours. The dish was transferred to desiccator. The samples were weighed as soon as it reached the room temperature), dry matter (the actual weight of the sample after drying), and sprouting percentage were collected and analyzed in accordance with Steel & Torrie, (1980) by using MSTAT C statistical analysis software. The onion bulbs were weighed and kept for storage at room temperature range 27-31^{o}C and RH 50% and cold store conditions (temperature range 0-1°C and 70-75% RH) on 8th June, 2006. Samples were weighed in three categories, small size bulbs (5 cm or less in diameter), medium size bulbs (6-7 cm in diameter) and large size bulbs (more then 7 cm in diameter) in accordance with Gajewski (1994). Data on bulbs sprouting in room stored onions were recorded after 94 days, whereas on cold stored onions after 170 days on the onset of sprouting. It is worth mentioning here that bulbs stored at room temperature started sprouting 76 days earlier than cold stored bulbs.

Results and Discussion

Plant height: It is revealed from Table 2 for plant height (cm) that there was a significant difference ($p \leq 0.001$) among different potash sources and among the mean values of various levels of potash. The interaction between sources and levels of potash was non significant. The maximum plant heights (61.13 and 61.33 cm) were recorded where 75 and 100 kg potash ha^{-1} was applied followed by 50 kg ha^{-1} with 60.18 cm plant height, while the minimum plant height (57.48 cm) was recorded in control. Similar findings were reported by Koondhar (2001) that maximum plant height of Phulkara onion was recorded in the plots that received 100-80-75 kg NPK ha^{-1}. Hassanpouraghdam *et al*., (2008) also reported that different concentrations of N and K influenced height of the plants, the greatest height being observed in N and K with 200 mg L^{-1} each . They concluded that different concentrations of N and K have remarkable effects on the growth. Sulphate of potash produced significantly tallest plants (60.58 cm) as compared to Muriate of potash (59.04 cm). This may be due to the availability of more readily available forms of potassium and sulfur than other sources. Potassium added as muriate of potash caused a significant depression in plant growth and seed cotton yield than that of sulphate of potash (Pervez *et al*., 2004).

Number of leaves plant^{-1}: Table 2 indicates non significant differences among the different potash sources on number of leaves plant^{-1}. However, different levels applied had significant ($p \leq 0.001$) effect. The interaction between sources and levels of potash was non significant. The maximum numbers of leaves per plant (14.38) was recorded with potash @ 75 kg ha^{-1} followed by 25, 50 and 100 kg ha^{-1} with 13.70, 14.02 and 13.48 leaves plant^{-1} respectively. While the minimum leaves plant^{-1} (10.63) was recorded in the control. It could be the reason that in some crops the numbers of leaves is specified by genotypes. Similarly also Koondhar (2001) reported by that the highest number of leaves (9.18) was obtained when the plots received 100-80-75 kg NPK per hectare. Pettigrew (2008) reported that potassium deficiency can lead to a reduction in both the number of leaves produced and the size of individual leaves. The treatment of sulphate of potash produced a non significant numbers of leaves plant^{-1}.

Plant diseases incident percentage: There were significant differences ($p \leq 0.05$) among the different potash sources and mean values of various levels of potash. The interactions between sources and levels of potash were however, non significant (Table 2). The data show that MOP treated crop had significantly higher disease incidence (62.87%) as compared to SOP (57.0%). The maximum disease incidence (69.67%) was recorded in control treatment followed by 25 kg ha^{-1} with 62.50% disease incidence, while the minimum disease incidence (50.17%) was noted in 100 kg K_2O ha^{-1} followed by 58.67% each in 75 and 50 kg K_2O ha^{-1} respectively. Mandal *et al.*, (2008) reported that application of 40 kg K ha^{-1} reduced percent disease index (PDI) by more than 10% compared with 0 kg K ha^{-1} treatment. Muriate of potash treated crop produced significantly higher disease incidence as compared to SOP. This might be the presence of sulfur in the SOP, which may have enhanced the disease tolerance in the plants. Sulfur was highly toxic (ED50 1-3 microgram ml^{-1} to many fungal pathogens. (Cooper & Williams, 2004).

Yield of onion bulbs (tons hectare^{-1}): There were significant differences ($p \leq 0.05$) among the different potash sources and various levels of potash. The interactions between sources and levels of potash were found non significant (Table 2). Sulphate of potash treated crop produced higher yield (32.2 tons ha^{-1}) as compared to MOP (28.2 tons ha^{-1}). The maximum yield of bulbs (34.53 tons ha^{-1}) was recorded with potash @ 75 kg ha^{-1} followed by 33.93 tons ha^{-1} yield with 100 kg K_2O ha^{-1}. While the minimum bulbs (23.55 tons ha^{-1}) were recorded in control, followed by 26.6 tons ha^{-1} yield with 25 kg K_2O ha^{-1}. According to Koondhar (2001) that the highest bulb yield (48.67 kg) was obtained when the plots received 100-80-75 kg NPK per hectare. Sulphate of potash treated crop produced higher yield as compared to MOP. Similar finding was reported by Pervez *et al.*, (2004) that potassium added as muriate of potash caused a significant depression in seed cotton yield than that of sulphate of potash.

Weight of large size bulbs (tons hectare^{-1}): Table 2 reveals that there were non significant differences among the different sources of potash. However, different levels of potash had a significant $p \leq 0.01$ difference among there mean values. The interaction between sources and levels of potash was found non significant. The maximum yield (7.0 tons ha^{-1}) of large size bulbs was obtained by potash treated crop @100 kg ha^{-1} followed by 50 and 75 kg K_2O ha^{-1} with the yield of 5.80 and 6.13 tons ha^{-1} respectively. Whereas minimum bulbs (2.22 tons ha-1) were recorded in control. This result conforms the findings of Ehsan *et al.*, (2002) and Ghaffoor *et al.*, (2003), who obtained high yield of bulbs from 50 to 200 kg potash ha^{-1} with different combination of N and P fertilizers. The trend of production of larger bulbs showed that MOP encouraged larger bulbs as compared to SOP. This trend was also previously reported by Nabi *et al.*, (2000) that SOP encourages the formation of small and medium size tubers, while MOP promotes formation of large tubers.

Weight of medium bulbs (tons hectare^{-1}): There were significant differences ($p \leq 0.01$) among the different potash sources and various levels of potash (Table 2). The interactions between sources and levels of potash were non significant. It is evident form the data that SOP produced higher medium size (8.85 tones ha^{-1}) bulbs as compared to MOP (5.20 tones ha^{-1}). Similarly Nabi *et al.*, (2000) reported by that SOP encourages the formation of small and medium size tubers, while MOP promotes formation of large tubers. The maximum medium size bulbs (10.80 tons ha^{-1}) was recorded in potash treated crop @ 75 kg ha^{-1} followed by 50 and 100 kg K_2O ha^{-1} with 6.80 and 10 tons yield ha^{-1} respectively, whereas the minimum weight (3.47 tons ha^{-1}) was produced by control followed by 4.27 tons ha^{-1} with 25 kg K_2O ha^{-1}. The trend is almost the same as large size bulb production. This result is in agreement with findings of Ehsan *et al*., (2002) and Ghaffoor *et al*., (2003), who obtained high yield of bulbs from 50 to 200 kg potash ha^{-1}.

Weight of small bulbs (tons hectare^{-1}): There were non significant differences among the different sources and levels of potash and even the interactions between these factors (Table 2). But If look at the data in table 2, the production of small bulbs were more as compared to medium and large size bulb in control but still it was not significantly higher than small bulbs of different potassium fertilizer treated onion crop, which had higher and more medium and larger bulbs. It means that the treatment of potassium showed its effect on the bulbs size. Moreover, all root crops generally response more by the application of potassium (Ali *et al*., 2007).

Bulb firmness (lbs): There were significant differences ($p \leq 0.001$) among the different sources of potash and various levels of potash (Table 3). The interactions between sources and levels of potash were non significant. It is clear from the data that sulphate of potash encouraged the higher bulb firmness (7.93 lbs) as compared to MOP (6.84 lbs). The maximum bulb firmness (8.17 lbs) was recorded with potash treated crop @100 kg ha^{-1} followed by 8.08 and 7.80 lbs with 75 and 50 kg K_2O ha^{-1} respectively. The minimum bulb firmness (6.52 lbs) was recorded in control followed by 6.35 lbs with 25 kg K_2O ha^{-1}. Similar response of fruit firmness to potash was also reported by Demiral & Koseoglu (2005) that melon fruit firmness was higher than the control at the potassium 400 and 600 mg L^{-1} rates and total soluble solids were higher than the control at 600 mg K L^{-1} rate.

Dry matter contents (%) of onion bulbs: There were significant differences ($p \leq 0.001$) among the different potash sources and the means of various levels of potash. The interactions between sources and levels of potash were non significant (Table 3). Sulphate of potash encouraged bulbs with significantly higher dry matter (18.05%) as compared to 16.22% with MOP treated crop. The maximum dry matter (18.88%) of bulbs was found in potash @100 kg ha^{-1}, followed by 17.65 and 18.75% with the treatment of 50 and 75 kg K_2O ha^{-1} respectively. The minimum dry matter of bulbs (14.50%) was detected in control followed by 15.90% with 25 kg K_2O ha^{-1}. This finding is the confirmation of Masalkar *et al*., (2005 b) that TSS, total sugars, non-reducing sugars and dry matter were increased significantly with increase in potash levels. Hassanpouraghdam *et al*., (2008) also reported that N and K treatment combinations influenced fresh and dry weight of costmary (*Tanacetum balsamita* L.) leaves and the greatest amount was recorded in 200 (N) and 200 (K) mg L^{-1}. Similarly Mojsevich (2008) reported that with the increase of doses of the main fertilizer NPK 70, 45, 70 kg ha^{-1} to NPK 110, 75, 110 kg ha^{-1} caused the increase of dry matter content in bulbs from 14,6% to 15,5%. Sulphate of potash produced significantly higher dry matter in bulbs as compared to MOP. The presence of sulfur in SOP fertilizer could decrease the soil pH, which in turn increase the availability of zinc, iron and manganese to the plant. Increasing sulphur supply level significantly increased the biomass (Songzhong Liu, 2009).

Moisture contents (%) of onion bulbs: Then was significant differences ($p \leq 0.001$) among the different sources and the means of various levels of potash (Table 3). The interactions effect were non significant. Data shows that Muriate of potash encouraged bulbs with significantly higher moisture (83.78%) as compared to SOP possessing 81.95% moisture. The higher moisture of 85.51% in bulbs was recorded in control followed by 84.1% moisture with 25 kg K2O ha-1, while the lower moisture in bulbs (81.12%) were found in 100 kg K2O ha-1 followed by 82.35 and 81.25% with 50 and 75 kg K2O ha-1 respectively. During this study the moisture content and dry matter content are indirectly proportional to each other. Murray (2005) reported that higher the dry matter content the lower the water content in potatoes. The use of the sulphate form of potassium fertilizer (sulphate of potash) can result in dry matter and less moisture contents thus higher specific gravity tubers than when the chloride form is used (muriate of potash).

Pungency percentage in bulbs: The data in Table 3 show that there were significant differences ($p \leq 0.001$) among the different sources, various levels of potash ($p \leq 0.01$) and the interactions between sources and levels of potash ($p \leq 0.05$). It is evident from the data that crop treated with SOP showed significantly more pungent bulbs (62%) as compared to MOP (34%). The maximum pungent bulbs (65%) was observed in potash @100 kg ha^{-1} followed by 60 and 45% pungency with 75 and 50 kg K_2O ha^{-1} respectively, while the minimum (35%) pungent bulbs were produced in control and 25 kg potash ha^{-1} respectively. The highest pungent onion bulbs (90%) were recorded with SOP @ 100 kg K_2O ha^{-1}, while minimum pungent bulbs (20%) were recorded in MOP @ 25 kg K_2O ha^{-1}. Pungency depends on variety but fertilizers also may play their role. As the onion matures the dry matter and pungency increases (Shika & Doug, 2001). Shakirullah *et al*., (2002) reported that maximum pungency was found in the sulfur treated onion crop as compared to control suggesting that sulfur plays an important role in pungency of the onion. We also found that onion crop treated with SOP created significantly more pungent bulbs as compared to MOP. As SOP contains sulfur therefore, it may affect the pungency of the bulbs. Moreover it was also found that SOP treated crop produced the highest pungent onion bulbs @ 100 kg K_2O ha^{-1}, while minimum pungent bulbs were recorded in MOP @ 25 kg K_2O ha^{-1}., again this is in the with the findings of Shakirullah *et al*., (2002).

Total Soluble Solids (°brix) of onion bulbs: There were significant differences ($p \leq 0.001$) among the different sources, among the means of various levels of potash ($p \leq 0.001$) and the interactions between sources and levels of potash ($p \leq 0.05$) (Table 3). Sulphate of potash had a significant higher TSS (10.72 °brix) as compared to MOP (9.07 °brix). The maximum TSS (11.76 °brix) of bulbs was found in onion crop treated with 100 kg K_2O ha^{-1} followed by 11.45 °brix with 75 kg K_2O ha^{-1}. The minimum TSS of bulbs (7.52 °brix) was noticed in control. The interactions between these factors show that highest TSS of onion (13.12 °brix) was recorded in SOP at the rate of 100 kg K_2O ha^{-1}, while minimum TSS (7.30 °brix) was found in control. Masalkar et al. (2005 b) found that TSS, total sugars, non-reducing sugars and dry matter were increased significantly with increase in potash levels. Similarly Demiral & Koseoglu (2005) reported that total soluble solids of melon fruit were higher than the control at the K 600 mg L^{-1}. Sulphate of potash encouraged significantly higher TSS content in the bulbs as compared to MOP. Similarly, Pervez *et al*., (2004) reported that SOP produced significantly higher yield and yield attributes as compared to MOP. The interaction between these factors showed that highest TSS was acquired by the bulbs treated with SOP @ 75 and 100 kg K_2O ha^{-1}, while minimum TSS was found in control. Masalkar *et al*., (2005 b) and Demiral & Koseoglu (2005) got high TSS with potassium higher doses.

Comparison of weight loss of bulbs stored in cold store and at room temperature: There were significant differences ($p \leq 0.05$ and 0.01) in weight losses among the different levels of potash in room stored and cold stored onions, respectively. As Masalkar *et al.*, (2005 b) investigated that bulb weight, TSS, total sugars and dry matter were increased significantly with increase in potash levels. This greater amount of dry matter and TSS contents of the bulbs may help to have less moisture content in the bulb and thus due to the less amount of moisture the weight loss may also be very limited. This trend may be linked with dry matter and moisture contents of the bulbs. As it was noted previously (Table 3) that higher moisture content of bulbs was found in control and lower dozes of potash treatments. Whereas, the higher weight loss has also occurred in control and at lower dozes of potash. It means that high moisture content of the bulbs may be directly linked with more weight loss of the bulbs as also reported by Masalkar *et al*., (2005b) and Shakirullah *et al*., (2002). The mean values of potash sources were non significant in room stored onions, while significant differences was in cold stored onions. This may be the fact that the mean weight loss was 45.7% occurred in room stored onions in 94 days period while 22.4% weight loss occurred in 170 days in cold stored onions. It means that weight loss at room temperature was more and rapid and cause non significant results, while in contrast weight loss was less and slow in cold stored onions and showed significant effect (Table 4).The interactions among these factors in both storages were non significant. The whole mean difference between the weight losses of onion bulbs placed in cold store and at room temperature were 23.3. The trend of weight loss was same in both conditions i.e., the maximum weight loss was noted in control, while with increase of potash levels in both sources (SOP or MOP) the decrease in weight loss was observed. It is also worth mentioning that weight loss in SOP was less as compared to MOP. Ullah *et al*., (2008) reported that minimum bulbs weight loss occurred with sulfur application @ 45 kg ha^{-1}. They concluded that application of sulphur enhanced the storability of onion bulbs. Moreover, Sulphate of potash contains sulfur having a good effect on bulb weight. Shakirullah *et al*., (2002) reported that maximum bulbs weight was found where sulfur was applied @160 kg ha^{-1}. Similar findings previously reported by Masalkar *et al*., (2005 b) that bulb weight was increased significantly with increase in potash levels.

Comparison of sprouting (%) of bulbs stored in cold store and at room temperature: In case sprouting of bulbs at room temperature, there were significant differences ($p \leq 0.05$) among the different levels of potash. However, the mean values of both potash sources and the interactions among these factors were non significant. The maximum sprouting (29.50%) of bulbs was recorded with control treatment, followed by 25, 50 and 75 kg potash ha^{-1} with 19.44, 18.33 and 16.61% respectively while the minimum sprouting (9.39%) occurred in the treatment of potash @100 kg K_2O ha^{-1}. This is in agreement with the finding of Masalkar *et al*., (2005 a) also reported that sprouting of bulbs in storage had declined during both seasons with successive increase of potash and was much faster in Kharif (summer) than in Rabi (winter) season. It may also be possible that high moisture content of the bulbs in control and lower dozes of potassium

may encourage the early phsio-chemical changes of bulbs like sugar formation etc., and may cause early sprouting. In case of sprouting of bulbs in cold store there were significant differences ($p \leq 0.001$) among the mean values of different levels of potash and between the potash sources ($p \leq 0.001$), while the interactions among these factors were non significant. The bulbs of MOP treated crop were more sprouted (8.48%) as compared to SOP (4.79%). The maximum sprouting (12.21%) of bulbs was recorded in control, while the minimum sprouting (1.73%) occurred in the treatment of potash @ 100 kg K_2O ha^{-1}. MOP treated onion crop produced bulbs with more moisture contents, which may provide favorable conditions for sprouting as well as rotting. This trend looks similar as previously noted in bulbs stored at room temperature but the only difference is duration of storage. The bulbs stored at room temperature sprouted 76 days earlier than the cold stored onions. Mean differences between the sprouting (%) of onion bulbs placed in cold store and at room temperature was more than 12.02 (Table 5). The mean sprouting percentage in bulbs stored at room temperature was 18.65%, while in cold-stored bulbs was 6.63% (Table 5). The trend of bulbs sprouting was same in both conditions i.e., the maximum sprouting occurred in control. Moreover it was observed that with the increase of potash levels irrespective of the sources (SOP or MOP), sprouting decreased. However, sprouting of bulbs in SOP was less as compared to MOP. The findings were also in agreement with Krawiec (2002), who preferred low temperature for better storage of onion bulbs. The trend of bulbs sprouting was the same in both conditions i.e., the maximum sprouting occurred in control. Moreover, it was observed that with increase of potash levels in both sources (SOP or MOP) the decrease in sprouting was observed. However, onion bulb sprouting in SOP was less as compared to MOP as also reported by Masalkar *et al.*, (2005 a).

Conclusion

Maximum plant growth, medium and large size bulbs, yield ha^{-1}, bulb firmness, pungency, TSS of bulbs, were gained by onion crop treated with 75 and 100 kg K_2O ha^{-1}. The minimum moisture of bulbs, disease, sprouting, weight loss bulbs was noticed in 100 kg K_2O ha^{-1}, followed by 75 K_2O ha^{-1}. SOP produced highest plant height, small bulbs, medium size bulbs, firmed bulbs, dry matter, pungent bulbs, TSS of bulbs, as compared to MOP. The mean differences between the weight losses and sprouting of onion bulbs placed in cold store and at room temperature were more than 23 % but the response of the onion bulbs regarding weight loss and sprouting in both conditions were quite similar. The mean loss of weight in bulbs stored at room temperature was 47.7% while in cold-stored bulbs was 22.4%. Similarly the mean sprouting percentage in bulbs stored at room temperature was 18.65% while in cold-stored bulbs was 6.63%. The trend of weight loss and sprouting was same in both conditions i.e., the maximum weight loss and sprouting was noted in control while with increase of potash levels in both sources (SOP or MOP) the decrease in weight loss and sprouting was observed. The weight loss and sprouting in SOP was less as compared to MOP.

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(Received for publication 25 May 2009)