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Evaluation of Onion Breeding Lines for Table Purpose

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ABSTRACT

For the development of stable variety for table purpose, 68 breeding lines were developed through mass selection from the selected bulbs. All the lines, along with checks, were evaluated at ICAR-DOGR, Rajgurunagar, Pune (MS). Out of 68 breeding lines, seven lines *viz.*, DOGR-546-DR, KH-M-1, KH-M-2, KH-M-3, KH-M-4, RGP-1 and RGP-2 have been entered in AINRPOG on the basis of their superiority over the best check. DOGR-546-DR (373.40 q/ha) showed 18.3% marketable yield superiority over the best check. It has very good bulb storability, 64.7 g average bulb weight, free from bolters and suitable for *rabi* season. KH-M-1 (353.30 q/ha) and KH-M-2 (359.85 q/ha) were suitable for *kharif* season and showed 23.4% and 25.7% marketable yield superiority over the best check, respectively. These lines have dark red bulbs and early in maturity. RGP-1 (328.60 q/ha) and RGP-2 (369.15 q/ha) were suitable for *rabi* season and showed 17.5% and 32.0% marketable yield superiority over the best check. Two lines, namely KH-M-1 and KH-M-2,were found best in respect of earliness, stability and quality yield during *kharif*.

KEYWORDS

Onion, advance lines, growth, yield and quality parameters, breeding

INTRODUCTION

Onion is basically a cool-season crop mainly grown in *rabi* season, but can also be cultivated in *kharif* and late *kharif* season. Since past, various season-wise varieties have been recommended for onion. Evaluation of newly developed genotype is a continuous process with a quest for finding most adapted and high yielding varieties with desirable horticultural traits for particular cropping season. The main objective of many plant breeding programs is the selection of genotypes that are consistently high yielding in different cropping seasons. Identification of suitable varieties for different seasons is an important task in the prospect of achieving sustainable agricultural production. Development of varieties for specific cropping season is essential as a change in cropping season will affect the bulb yield by causing quantum share in unmarketable yield expressed through bolting, doubles and sometimes even no bulb formation. The yield of available varieties is low as compared to the world average. Amongst the onion producing countries, India being a second major onion producing country in the world, its productivity is 17 t/ha only (Anonymous, 2017). Increasing productivity to meet the world average is an important challenge. Thus, breeding of red onion for high yield, good storability and desirable horticultural traits and its availability throughout the year will help to increase the productivity and stabilize the prices of onion besides more profit to the farmers as well as earn foreign exchange. Also, the development of varieties for specific cropping season will help to achieve more output with the same amount of input which in turn is most essential and beneficial for attaining national food security by managing the gaps and gluts in the supply chain. Keeping this in view, the present study was carried out to identify the red onion lines suitable for *kharif*, late *kharif* and *rabi* cultivation in order to achieve the above objectives.

MATERIALS AND METHODS

Sixty-eight breeding lines of red onion were evaluated along with checks in 6×1 m plot size with three replications during *kharif*, late *kharif* and *rabi* (2010-11 to 2014-15)at the experimental farm of ICAR-Directorate of Onion and Garlic Research, Rajgurunagar, Pune (Maharashtra).Recommended cultural practices were followed during the entire growth period of the crop. Experiment was laid out in Randomized Block Design with three replications. The observations were recorded in each lines from five randomly selected plants and bulb yield on plot basis in each replication on twenty-one important growth, yield and quality parameters *viz.*, plant height (cm), number of leaves per plant, collar thickness (mm), polar diameter (mm), equatorial diameter (mm), neck thickness (mm), average bulb weight (g), percent A grade bulbs, percent B grade bulbs, percent C grade bulbs, percent double bulbs, percent bolter bulbs, percent unmarketable bulbs, percent marketable bulbs, marketable yield and total yield (t/ha), days to harvesting, percent plant establishment, total soluble solids (%), bulb centerness and bulb storability. All statistical analysis was carried out based on twenty-one traits using INDOSTAT software available in the Directorate to identify the lines suitable for *kharif*, late *kharif* and *rabi* cultivation.

RESULTS AND DISCUSSION

The present investigation revealed the significant variation among 68 lines in *kharif*, late *kharif* and *rabi* seasons, which indicates the presence of significant genetic variability for all the important traits. Mass selection is the best method for onion improvement hence, after massing and selection of desirable bulbs in the different population, seven red onion lines have been entered in AINRPOG trials on the basis of its superiority over check varieties. The specific varietal performance of seven

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lines, namelyDOGR-546-DR, KH-M-1, KH-M-2, KH-M-3, KH-M-4, RGP-1 and RGP-2 presented in the Table 1, Table 2 and Table 3. DOGR-546-DR was found suitable for *rabi* season (Fig. 1). Its bulbs were flat-globe in shape, dark red in colour and free from doubles and bolters. The average bulb weight was 64.7 g with a thin neck. This line produced 373.40 q/ha marketable yield, which was 18.30% higher than best check N-2-4-1 (315.70 q/ha) with very good bulb storability for four months.

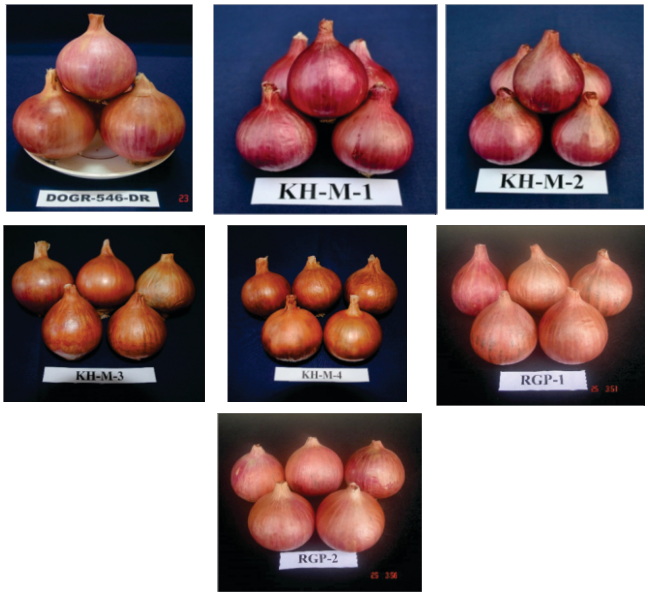

Fig. 1: Bulbs of advance breeding lines of red onion

On the basis of mean data, growth and quality parameters of promising lines along with checks were estimated (Table 1 and 2). During *rabi* season, the plant height ranged from 43.21 to 45.46 cm. Maximum plant height was recorded in RGP-2 (45.46 cm) followed by RGP-1 (45.09 cm) and KH-M-3 (45.04 cm) whereas the lowest plant height was recorded in DOGR-546-DR (43.21 cm). The number of leaves ranged from 6.90 to 7.90 and the maximum number of leaves were recorded in RGP-1 (7.90) followed by RGP-2 (7.77) and KH-M-3 (7.73). The minimum number of leaves was recorded in DOGR-546-DR (6.90). Collar thickness ranged from 7.69 to 8.88 mm. Maximum collar thickness was recorded in RGP-1 (8.88 mm) followed by KH-M-1 (8.80 mm) and KH-M-2 (8.64 mm) whereas least collar thickness was recorded in KH-M-4 (7.69 mm).

Polar diameter ranged from 43.50 to 47.34 mm. The maximum polar diameter was recorded in KH-M-2 (47.34 mm) followed by DOGR-546-DR (46.81 mm) and KH-M-3 (46.49 mm) whereas minimum polar diameter was recorded in KH-M-4 (43.50 mm). Equatorial diameter ranged from 50.61 to 53.36 mm. The maximum equatorial diameter was recorded in DOGR-546-DR (53.36 mm) followed by KH-M-2 (52.68 mm) and KH-M-3 (52.62 mm) whereas minimum equatorial diameter was recorded in RGP-2 (50.61 mm). Neck diameter ranged from 3.55 to 4.56 mm. Maximum neck diameter was recorded in KH-M-2 (4.56 mm) followed by KH-M-3 (4.45 mm) and KH-M-1 (4.29 mm) whereas the lowest neck diameter was recorded in KH-M-4 (3.55 mm).

Percentage of marketable bulbs ranged from 87.69 to 91.15%. The highest percentage of marketable bulbs was recorded in KH-M-3 (91.15%) followed by RGP-1 (90.98%) and KH-M-1 (88.92 %) whereas least percentage of marketable bulbs was recorded in RGP-2 (87.69%). Total Soluble Solids (TSS) ranged from 11.60 to 11.96%. Highest TSS was recorded in KH-M-2 (11.96%) followed by KH-M-1 (11.69%) and RGP-2 (11.65%) whereas the lowest TSS was recorded in KH-M-3 (11.60%). Centerness of bulb ranged from 1.28 to 1.41. The maximum value for centerness was recorded in KH-M-4 (1.41) followed by KH-M-1, RGP-2 (1.35) and KH-M-2 (1.33) whereas the lowest value was recorded in DOGR-546-DR (1.28). Plant establishment ranged from 75.50 to 88.22%. Highest plant establishment was recorded in DOGR-546-DR (88.22%) followed by KH-M-3 (81.07%) and RGP-1 (80.47%) whereas the lowest plant establishment was recorded in KH-M-1 (75.50%). The equatorial and polar ratio ranged from 1.11 to 1.17 and recorded maximum in KH-M-1, KH-M-4 (1.17) followed by RGP-1(1.15) and DOGR-546-DR (1.14) whereas the lowest ratio was recorded in KH-M-2 (1.11). Similar results were found for some of the common traits by Singh *et al.* (2017), Kamala *et al.* 2011 and Kamala *et al.* 2014.

During *kharif* season, the plant height ranged from 50.42 to 52.70 cm. The maximum plant height was recorded in KH-M-2 (52.70 cm) followed by KH-M-3 (52.33 cm) and RGP-2 (51.63 cm) whereas the minimum plant height was recorded in KH-M-4 (50.42 cm). The number of leaves ranged from 9.57 to 10.53 and the maximum number of leaves were recorded in KH-M-3 (10.53) followed by KH-M-4 (10.47) and RGP-1 (10.27) whereas the minimum number of leaves were recorded in KH-M-1(9.57). Collar thickness ranged from 10.98 to 12.71 mm. Maximum collar thickness was recorded in DOGR-546-DR (12.71 mm) followed by KH-M-2 (12.17 mm) and RGP-2 (12.14 mm) whereas minimum collar thickness was recorded in KH-M-3 and KH-M-4 (10.98 mm). Polar diameter ranged from 45.07 to 46.87 mm. The maximum polar diameter was recorded in KH-M-4 (46.87 mm) followed by KH-M-3 (46.73 mm) and DOGR-546-DR (46.69 mm) whereas minimum polar diameter was recorded in KH-M-1 (45.07 mm). Equatorial diameter ranged from 47.98 to 50.96 mm.The maximum equatorial diameter was recorded in KH-M-1 (50.96 mm) followed by KH-M-4 (50.59 mm) and DOGR-546-DR (50.53 mm) whereas minimum equatorial diameter was recorded in RGP-1 (47.98 mm). Neck diameter ranged from 3.95 to 4.59 mm. Maximum neck diameter was recorded in KH-M-4 (4.59 mm) followed by RGP-2 (4.56 mm) and RGP-1 (4.47 mm) whereas the lowest neck diameter was recorded in KH-M-1 (3.95 mm).

Percentage of marketable bulbs ranged from 91.15 to 93.58%. The highest percentage of marketable bulbs was recorded in KH-M-2 (93.58%) followed by KH-M-4 (93.10%) and KH-M-3 (93.08%) whereas least percentage of marketable bulbs was recorded in DOGR-546-DR (91.15%). Total Soluble Solids (TSS) ranged from 11.61 to 12.19%. Highest TSS was recorded in DOGR-546-DR (12.19%) followed by KH-M-3, KH-M-4 (12.07%) and RGP-2 (11.93%) whereas the lowest TSS was recorded in RGP-1 (11.61%). Centerness of bulb ranged from 1.07 to 1.27. The maximum value for centerness was recorded

in KH-M-1 (1.27) followed by KH-M-3, KH-M-4 (1.23) and KH-M-2 (1.17) whereas the lowest value was recorded in DOGR-546-DR (1.07). Plant establishment ranged from 73.33 to 87.33%. Highest plant establishment was recorded in KH-M-2 (87.33%) followed by KH-M-4 (84.15%) and RGP-1 (83.58%) whereas the lowest plant establishment was recorded in DOGR-546-DR (73.33%). The equatorial and polar ratio ranged from 1.03 to 1.13 and recorded maximum in KH-M-1 (1.13) followed by KH-M-2 (1.09), DOGR-546-DR and KH-M-4 (1.08) whereas the lowest ratio was recorded in RGP-1 (1.03). The results were in general consent with the research results of Dwivedi *et al.* (2012), Dewangan *et al.* (2012) and Hirave *et al.*(2015).

KH-M-1 was suitable for *kharif* season and its bulbs were dark red with a globe shape and almost free from doubles and bolters. The average bulb weight was 78.2 g with a thin neck. This line produced 353.30 q/ha marketable yield which was 23.40% higher than best check Bhima Super (286.30 q/ha). It was an early maturing and harvested within 97 days. KH-M-2 was suitable for *kharif* season and its bulbs were medium red, flat-globe with a thin neck and average bulb weight of 74.7 g. This line produced 359.85 q/ha marketable yield, which was 25.68% higher than best check Bhima Super (286.30 q/ha). It was free from doubles and bolters.KH-M-3 was suitable for *kharif* season and its bulbs were medium red with flat-globe shape and 2.33% double bulbs but almost free from bolters.

This line produced 294.41 q/ha marketable yield which was 27.88% higher than the best check Bhima Dark Red (212.31 q/ha). It was early maturing and harvested within 95 days after transplanting.KH-M-4 was suitable for *kharif* season and its bulbs were dark red with globe shape. This line produced 300.85 q/ha marketable yield which was 29.42% higher than the best check Bhima Dark Red (212.31 q/ha). It was early maturing, harvested within 95 days after transplanting and free from doubles and bolters.

RGP-1 was suitable for *rabi* season and its bulbs were offlat-globe shape with medium red colour. It produced uniform bulbs and was free from doubles and bolters. This line produced 328.60 q/ha marketable yield, which was 17.50% higher than best check Bhima Shakti (279.60 q/ha). The average bulb weight was 64.32 g with a thin neck. Its bulbs were harvested in 118 days after transplanting and good in storage.RGP-2 was suitable for *rabi* season and its bulbs were uniform, globe shaped with dark red colour. This line produced 369.15 q/ha marketable yield, which was 32.00% higher than best check Bhima Shakti (279.60 q/ha). It was free from doubles and bolters. The average bulb weight was 72.44 g with a thin neck. It was harvested in 116 days after transplanting and has good bulb storability.

The present result confirms the findings of Kamala *et al,* 2011 and 2014. Mahajan *et al*. 2012 have described onion and garlic varieties released by ICAR-DOGR and very early maturing line identified by Gupta *etal*.2015.Season-wise onion varieties have been described by Lawande and Gupta, 2015; and Mahajan *et al.* 2015.DOGR-546-DR, RGP-1 and RGP-2 were suitable for *rabi* season. On the basis of mean data, DOGR-546-DR recorded 373.40 q/ha marketable yield which showed 18.30% superiority over best check whereas RGP-1 and RGP-2 recorded 328.60 q/ha and 369.15 q/ha marketable yield which showed 17.50% and 32.00% superiority over the best check, respectively. These findings were similar to Ambresh and Gowda, 2013; Satyanarayana, 2014; Mahajan and Gupta, 2016; Mahajan *et al.* 2018; Suhas *et al*. 2018; Ram and Kumar, 2018.

The average bulb weight of DOGR-546-DR was 64.70 g whereas RGP-1 and RGP-2 had 64.32 g and 72.44 g, respectively. The bulbs of DOGR-546-DR were dark red with flat globe shape, RGP-1 was medium red with a flat globe shape and RGP-2 were dark red with globe shape. DOGR-546-DR was harvested in 109 days whereas RGP-1 and RGP-2 were ready to harvest in 118 and 116 days, respectively. DOGR-546-DR, RGP-1 and RGP-2 were free from doubles and bolters. DOGR-546-DR had very good storability whereas RGP-1 and RGP-2 were good in storability.

KH-M-1, KH-M-2, KH-M-3 and KH-M-4 were suitable for *kharif* season. On the basis of mean data, KH-M-1 recorded 353.30 q/ha marketable yield which showed 23.40% superiority over best check whereas KH-M-2, KH-M-3 and KH-M-4 recorded 359.85 q/ha, 294.41 q/ha and 300.85 q/ha which showed 25.68%, 27.88% and 29.42% superiority over best check, respectively. These findings were similar to the findings of Ambresh and Gowda, 2013; Satyanarayana, 2014; Mahajan and Gupta, 2016; Mahajan *et al.* 2018; Suhas *et al.* 2018; Ram and Kumar, 2018.

The average bulb weight of KH-M-1was 78.20 g whereas KH-M-2, KH-M-3, and KH-M-4 recorded 74.70 g, 59.66 g, and 61.58 g, respectively. The bulbs of KH-M-1 and KH-M-4 were dark red with globe shape whereas KH-M-2 and KH-M-3 were medium red with flat globe shape. KH-M-1, KH-M-2, KH-M-3, and KH-M-4 were ready to harvest within 100days and were free from doubles and bolters. KH-M-1, KH-M-2, KH-M-3, and KH-M-4 were medium in storability.

CONCLUSION

Sevenred onion lines *viz.* DOGR-546-DR, KH-M-1, KH-M-2, KH-M-3, KH-M-4, RGP-1 and RGP-2 have been entered in AINRPOG trials on the basis of its superiority over released varieties. Although all the lines had desirable traits, two lines, namely KH-M-1 and KH-M-2, were found best in respect of earliness, stability, and a quality yield.

REFERENCES

Ambresh and Veere Gowda R. 2013. Studies on heterosis for purple blotch disease and bulb yield using male sterile lines in onion (*Allium cepa* L), *Asian J. Hort*.**8** (1): 68-70.

Anonymous 2017. Indian Horticulture Database 2017, National Horticulture Board (Ministry of Agriculture), Gurgaon, p. 485.

Dewangan SR, Sahu GD and Kumar A. 2012. Evaluation of different *kharif* onion genotypes in Chhattisgarh plains. *Indian Horticulture Journal* **2**: 43-45.

Dwivedi YC, Kushwah SS and Sengupta SK. 2012. Evaluation of onion varieties for growth, yield and quality traits under agro-climatic condition of Kymore plateau region of Madhya Pradesh. *Agriculture Science Digest-A Res J*. **32**:326-328.

Gupta AJ, Mahajan V and Gopal J. 2015. DOGR-1203-DR (IC0598327;

INGR 14057), an onion (*Allium cepa* L.) germplasm with very early maturity and 100% uniform neck-fall. *Indian J. Plant Genet. Resour.***28**(3): 368-369.

Hirave PS, Wagh AP, Alekar AN, Kharde RP. 2015. Performance of red onion varieties in *kharif* season under Akola conditions. *Journal of Horticulture* **2**:132. Doi:10.4172/2376-0354.1000132.

Kamala V, Gupta AJ, Rajput AS, Sivaraj N, Pandravada SR, Sunil N, Varaprasad KS and Lawande KE. 2014. Diversity in bulb traits in onion germplasm collected from Chhattisgarh and Maharashtra. *Indian Journal of Horticulture***71**(4): 499-504.

KamalaV, Gupta AJ, SivarajN, Pandravada SR, SunilN, Varaprasad KS and Lawande KE.2011. Diversity analysis of onion germplasm collections from Northern Telangana region of Andhra Pradesh. *Indian Journal of Plant Genetic Resources***24** (2): 163-171.

Lawande KE and Gupta AJ. 2015. Onion *In:* Olericulture-II: Vegetable production and improvement (*Eds*; K.P. Singh and A. Bahadur). Published by Kalyani Publishers, Noida. p. 245-281.

Mahajan V and Gupta AJ 2016. Development of photo and thermo-insensitive cultivars of short day onion in India. *Acta Horticulturae*. 1143: 61-68.

Mahajan V, Gupta AJ, Lawande KE and Singh M 2018. Onion improvement in India. *Journal of Allium Research* 1(1): 7-20.

Mahajan V, Khar A, Gupta AJ and Gopal J. 2012. Onion and garlic varieties of DOGR, Technical Bulletin No. 20, Published by ICAR-Directorate of Onion and Garlic Research, Rajgurunagar, Pune p. 9.

Mahajan V, Negi KS and Gupta AJ. 2015. Biosystematics, botany and genetic resources. *In*: The Onion (*Eds:* N.K. Krishna Kumar, J. Gopal and V.A. Parthasarthy). Published by ICAR-DKMA, New Delhi. p. 30-55.

Ram B and Kumar U. 2018. Performance of onion (*Allium cepa* L.) genotypes for growth, yield and quality. *International Journal of Chemical Studies* 2018; SP4: 128-131

Satyanarayana P. 2014. M.Sc. Thesis title Heterosis and combing ability studies for yield and quality traits in onion (*Allium cepa L.*). PAU, Ludhiana.

Singh P, Soni AK, Diwakar P, Meena, AR and Sharma D. 2017. Genetic variability assessment in onion (*Allium cepa* L.) genotypes. International Journal of Chemical Studies **5(5)**: 145-149.

Suhas Y H, Amarananjundeswara H, Tejaswini, HR, Jagannath, HR and Lakshmipathi N.2018. Evaluation of onion genotypes (*Allium cepa* L.) for yield and quality parameters during *kharif* season in Eastern Dry Zone of Karnataka. *Int. J. Pure App. Biosci.* 6 (6): 552-557.

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