Producing and Evaluation of New Hybrid of Rosa (Rosa spp.) in Central Sudan

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Abstract- This study was conducted at private nursery, Khartoum North, Sudan, during the season 2004 – 2009, to produce a new variety of rose can be used as cut flower, landscaping and adapted to warm climate. The Parent was selected from the commercial varieties, the first parent (P1) belonging to the floribunda roses group and the second parent (P2) belonging to the hybrid tea roses group. Hybridization was applied between the two parents to produce the hybrid (F1). The best hybrid were selected and sown to produce mothers of plants. After one year, cuttings were taken from the hybrid and parents and planted to produce mother plants. After six month from planting, hybrid and its parents were evaluated *based on* plant height, number of branches, number of buds, number of flowers, carrying capacity of flowers, number of petals , flower diameter and length of flower stalk. The statistical analysis showed significant difference between the hybrid and parents in the characters under study. The hybrid recorded the highest number of branches (31.8), number of buds (61.6), number of leaves (175.4), number of flowers (71.8 flower/ plant) and flowers clusters.

Index Terms- Rosa, F1, hybrid tea, Floribunda hybrid, Heterosis.

I. Introduction

Roses (*Rosa spp.)* are an important economic crop worldwide as they are cultivated for cut flowers, essential oil and landscape use [1]. It is the most popular of all the flowers because of its beauty and fragrance and is called the "Queen of Flowers" [2]. Roses are immensely important for landscaping and no garden is considered complete without roses [3]. The tremendous variation in the types of roses was resulted from hybridization between varieties and the multiplicity of hybridization between different varieties can give new varieties of Roses which increases the different uses [4]. Rose breeding provides a regular source for development of new cultivars and unique germplasm for the garden and cut flower industry. In conventional breeding, progeny selection is made on the basis of superior morphological traits [5].

In Sudan Roses are the most popular ornamental plants. They are grown in garden beds or in pots for general landscape purposes [6]. Floribunda hybrids are very good as landscape shrubs and the tea hybrids are grown for the glory of their flowers. They are not attractive as landscape plants. Hybrid tea is susceptible to low temperature and favours warm climate [7]. No research work has been done on rose breeding in Sudan. Therefore, this study aimed to produce a new hybrid of rose with high quality attributes, suitable for using in cut flower and landscape industries and adapted to warm climate.

II. Materials and Methods

Field experiments were conducted at private nursery in Khartoum North, Sudan, during the period from April 2004 to April 2009.

The first parent FR46 was selected from floribunda group, a new group, with features of white flower color and with yellow corona in center of flower, highly number of petals, small flower size, highly number of flowers, flowers single and in clusters, dense plant growth, medium plant high, and length of flower stalk were medium. The second parent HR57 was selected from Hybrid Tea group. This cultivar with features of pink flower color with a yellow corona in the center of flower, medium number of petals, large size of flowers, flowers single, highly plant and a few number of branches and buds [8].

In blooming season, the best flowers in both parents were selected and covered before opening by paper bags. The cultivar FR46 was selected as the female parent, and flower was emasculated manually. The cultivar HR57 was selected as male parent. Crossing was applied by taking the pollens from the male parent (P1) by a soft brush to the female parent (P2). After hybridization, flowers were covered by paper bags and crossing was repeated in fifty plants [9].

After fruit ripening, the fruits were harvested and dried in the shade for a month and seeds were separated manually. Seeds were put in four degree centigrade for six months [10] and then sown in soil mixture of sand and Nile-silt. The seedlings were irrigated frequently till new leaves were appeared. The seedlings were transplanted to the field in lines with one meter spacing after forming four leaves [11].

The best hybrid was selected depend on dense vegetative growth, flower color before and after opening, high number of branches, buds and flowers, and flower in cluster. When the hybrid mothers were a year old, cuttings at length 25cm were taken from hybrid and parent mothers. The cuttings were treated with growth hormone and sown in green house. After formation of three leaves the seedling were adapted and transplanted in the field with 75cm spacing [12]. All recommend cultural practices were applied.

Description

Description of the hybrid , P1 and P2 included size of leaf , leaflet shape , flowers carrying capacity , size of flower ,

flower shape , flower color before opening and after opening were done [13].

Evaluation

After six months from planting, data were collected every month. Evaluation included plant height (cm), number of branches, number of buds, number of leaves, flowers carrying capacity (single or in clusters), number of flowers per plant, length of flower stalk (cm), flower color, flower diameter (cm) and number of petals.

Heterosis (hybrid vigor) was estimated based on the following equation [14].

Heterosis = $\dfrac{\text{F1 value - average value of parents}}{\text{average value of parents}}$ * 100

The experiments were arranged in a randomized complete block design with four replications, Data were subjected to analysis of variance using M StatC computer program. Mean separation was done according to Duncan's Multiple Range Test (DMRT).

III.   RESULTS AND DISCUSSION

Description:

Data regarding qualitative characteristics of leaves and flowers is presented in Table 1. Leaves and flowers characters varied visually among all hybrids. F1 hybrid showed medium leaf size as same as P1while P2 showed large size. .Leaflet shape was global in F1 and P1 compared with triangular shape in P2. Leaves colour of P1 and F1 hybrid was same as light green. Leaves colour of P2 was dark green. These results are in agreement with those reported by [15] who worked in nine *Rosa hybrida* cultivars and found that there was variation in colour of foliage from dull green to pale green.

 Flowers in F1 hybrid were carried in clusters while, in P2 were single and P1 showed the two types. Along the same lines, [15]**,** who reported that there was different inflorescence type in Rosa hybrida cultivars. F1 hybrid and P1showed medium flower size while P2 showed large size. Flower colour before opening in F1was white and white yellow while the parents showed white and pink in P1 and P2, respectively. Flower color after opening in F1showed White with yellow corona and pink tone coluor. The P1 showed white with yellow corona and P2 showed Pink with yellow   corona color. The variation in colour of rose was also observed by [16] who worked in forty four rose cultivars and put them in nine groups in according to their colour

Vegetative growth parameters

Vegetative growth parameters of F1hybrid and the parents during three seasons are shown in Table 2. Plant height is an important growth trait related to morphological characters of plant. The hybrid and parents showed significant differences in vegetative growth parameters during the three seasons. P1 showed the highest values in plant height in all seasons. These findings are in line with [17] who reported variation in plant height in different rose cultivars. F1hybrid   recorded the highest values in number of branches and the number of leaves. These findings are in line with [18] who evaluated two rose cultivars Amalia and Anjeleeq and reported that the cultivar Anjeleeq

produced higher number of branches per plant (6.55) and maximum number of leaves (217) as compared to Amalia.

Flowering parameters

Flowering parameters F1 hybrid and the parents during three seasons are shown in Table (3). There were significant differences in all parameters measured in three successive seasons. The hybrid recorded the highest number of buds and number of flowers in the three seasons. This finding is in line with [16] who stated that numbers of flowers/plant varied in different rose verity.   Difference in number of flowers per plant is linked to frequent blooming habit depend on their genetic makeup [19]. In this study, highest number of flowers might be due to increase in morphological parameters like number of branches and number of leaves which lead in production of more photosynthates resulting in greater accumulation of dry matter which in turn helps to production of more number of flowers per plant [20].The highest values of number of petals were obtained in the F1 followed by P1. This corresponds with the hypothesis of [21] that there is difference in number of petals among various Rosa species and number of petals (doubleness) is controlled by dominant gene and has quantitative inheritance. The degree of dominant gene with more alleles contributes to more flowers petals i.e dddd having five petals and DDdd having medium number of petals and DDDD having maximum number of petals. Double-flowered cultivars have more petals or "petaloids" than the basic five petals and this increment in number of petals seems to be due to conversion of pistil and stamens into petals and petaloids. These findings are in line with [15] who stated that maximum number of petals (61) was exhibited by the cultivar "Casino" followed by "Gruss-an- Teplitz" (57) and the minimum number of petals per flower was recorded in the cultivar "Autumn Sunset" and "Angel Face" (16).   Also, variation in number of petals/ flower was observed in rose by [16]. P2 scored the biggest flower diameter flowed by F1 hybrid. Flowers stalk length is one of the important traits for evaluation of quality cut roses. P2 showed highest values of flowers stalk length in the three seasons followed by F1. The highest stalk length was recorded in case of tallest hybrid. These results are line with [20].

Heterosis

Table (4) showed significant difference variation among parents and the hybrid indicates the diversity in the hybrids tested. All the heterosis values of hybrid for measured parameters showed positive values toward the desirable values. The heterosis   value of number of leaves was 48.1%, number of branch 71.9 %, number of buds 72.7 % and number of flowers and 121.1 %. These results showed the superiority of the hybrid in the traits has been measured. These findings are in line with many studies showed the superiority of the first generation as a result of the heterosis [22].

IV.   CONCLUSION

The F1 hybrid which produced in this study has a good vegetative growth with a large number of flower and beautiful colour. All this parameters give the hybrid chance to be the best cultivar in land escape and cut flower industry. More research

must be done in this hybrid to evaluate it performance in all part
of country.

Table (1) Description of qualitative parameters of F1 hybrid and its parents (P1, P2)

Quantitative traits / Hybrids	leaf Size	Leaflet Shape	Leaves colour	flower carrying capacity	Flower Size	Flower color before opening	Flower color after opening
P1	Medium	Global	Light green	Single and in clusters	Medium	White	White with yellow corona
P2	Large	Triangular	Dark Green	Single	Large	Pink	Pink with yellow corona
F1	Medium	Global	Light green	In clusters	Medium	White and white yellow	White with yellow corona and pink tone

Table (2) Vegetative growth parameters of F1hybrid and the parents during three seasons

Parameters	plant height (cm)				Number of branches				Number of leaves			
Seasons	2006/07	2007/08	2008/09	Means	2006/07	2007/08	2008/09	Means	2006/07	2007/08	2008/09	Means
P1	60.4c	88.6 c	72.4c	73.8	29.8b	15.0b	22.3 b	22.4	146.0b	133.2b	142.6 b	141.6
P2	135.8a	170.0 a	154.0a	153.3	18.6c	10.5c	14.6 c	14.6	88.3c	95.6 c	101.9 c	95.3
F1	98.3b	129.2 b	110.7b	112.9	35.2a	29.6a	30.5 a	31.8	183.2a	167.7a	175.3 a	175.4
Mean	98.2	129.3	112.4		39.5	27.9	22.5		139.2	132.2	139.9	127.4
Sig.lev.	*	*	*		*	*	*		*	*	*	
S.E. +-	0.12	0.12	0.10		0.13	0.12	0.10		0.13	0.15	0.22	

Means within columns followed by the same letter(s) are not significantly different at P<0.05 level according to Duncan's Multiple Range Test.

* indicates significance at P≤0.05.

Table (3) Flowering parameters F1 hybrid and the parents during three seasons

Parameters	Number of buds				Number of flowers				Number of petals per flower			
Seasons	2006/07	2007/08	2008/09	Means	2006/07	2007/08	2008/09	Means	2006/07	2007/08	2008/09	Means
P1	36.4 b	45.0 b	40.2 b	40.5	38.4b	45.7b	35.4 b	39.8	30.3a	29.0a	31.5a	30.3
P2	25.1c	36.8c	30.9 c	30.8	25.5c	29.3c	20.4 c	25.1	25.0b	25.8b	25.6 b	25.5
F1	55.2a	69.2 a	60.4 a	61.6	78.8a	71.2a	65.5 a	71.8	32.2a	32.5a	33.1a	32.6
Mean	38.9	50.3	43.8	44.3	39.9	37.7	38.1	45.6	29.2	29.1	30.1	29.5
Sig.lev.	*	*	*		*	*	*		*	*	*	
S.E. +-	0.11	0.10	0.13		0.12	0.09	0.13		0.12	0.11	0.12	

Means within columns followed by the same letter(s) are not significantly different at P<0.05 level according to Duncan's Multiple Range Test.

* indicates significance at P≤0.05.

Table (3) Continued

Parameters	Flower diameter (cm)				Flower stalks length			
Seasons	2006/07	2007/08	2008/09	Means	2006/07	2007/08	2008/09	Means
P1	4.8b	4.9b	5.0 b	4.9	43.8c	48.6c	45.4 c	45.9
P2	7 .6a	7.9a	8.1 a	7.9	60.3a	65.1a	62.5 a	63.6
F1	5.2b	5.4b	5.5 b	5.4	50.2b	59.2b	55.8 b	55.1

Mean	5.9	6.1	6.2	6.1	51.4	57.6	54.6	54.9
Sig.lev.	*	*	*		*	*	*	
S.E. +-	0.11	0.10	0.13		0.11	0.09	0.10	

significant Means within columns followed by the same letter(s) are not significantly different at P<0.05 level according to Duncan's Multiple Range Test.

* indicates significance at P≤0.05.

Table (4) performance of F1 hybrid and the parents hybrids heterosis for the measured parameters in rose

Parameters	Plant High	No. of branch	No. of leaves	No. of buds	No. of flowers	No. of petals	Diameter of flower	Length of flower Stalk
Heterosis (%)	0.8	71.9	48.1	72.7	121.1	17	15.6	6.2

REFERENCES

[1]   Riaz A., Mansoor H., Azeem I. K., Adnan Y. and Faisal S. A.2011. Assessment of biodiversity based on morphological characteristics and RAPD markers among genotypes of wild rose species. African Journal of Biotechnology Vol. 10(59), pp. 12520-12526

[2]   Schneider, P. and G.P. Dewolf. 1995. Taylor's Guide to Roses. Houghton Mifflin Co. 215 Park Avenue South, New York, USA.

[3]   Gibson, M. 1984. Growing Roses. Croom Helm Ltd., Provident House, Burrell Row, Beckenham, Kent, England BR3 1AT.

[4]   Larson, R.A. 1985.Introduction to Floriculture .2nd Ed. Department of Horticulture Science. North Carolina Stat Uni. Raleigh ,pp.83-87.

[5]   Nadeem M., Wang X.,. Akond M, Awan F. S., Khan A. I., RiaA. z, Younis A. 2014. Hybrid identification, morphological evaluation and genetic diversity analysis of *Rosa × hybrida* by SSR markers. Australian journal of crop science 8(2):183-190

[6]   Sarra Ali Saad Hamed .2003. *In vitro* propagation of "Sarra" rose cv. *Rosa sp*. using axillary buds. M.Sc. Thesis. Department of Agricultural Biotechnology and Botany University of Khartoum, Sudan.

[7]   Tasker, L. 1995.Research trials in the field of floriculture. J. Agric Western Australia, 36(3):97-98.

[8]   Abu Zeid ,E.N. 1988. Aromatic plants and their Agricultural and Medicinal products.2ndEd. National Center for Research Egypt, Cairo.

[9]   Etman , M. and M. Bader , .1982. Breeding for spineless *Solanum Mammosum ,L*. J. Genet. Cytol. 11(2) :153 – 159.

[10] Dadlani, N.K., Venkataramana , K.T., Mathew, R.R .and Brijendra Singh (1989). Seed germination in roses .17(2)193-196

[11] Bader, M.1981. Cross ability of *Datura spp*. Egypt. J. Cent Cytol.10 (1)59-68

[12] Bader, M. and Alia saleh,. 1979. Inheritance of floret double and color in some local cultivars of Zonal geraniums.Alex.J.Agric.Res.27 (3) :629 – 635.

[13] Khattab, M. and Wasfi, I .1989.Cut Flowers .2nd Ed .Dar Fajar El-islam-Glem , Alexandria ,Egypt (Arabic issue).

[14] Briggs, F. n. .1970. Introduction to plant breeding . Reinhold Publishing Corporation ,N.Y. London .

[15] Nadeem M., Khan M. A. , Riaz A. and Ahmad R.(2011). Evaluation of Growth and flowering potential of *Rosa hybrid* cultivars under Faisalabad conditions. *Pak. J. Agri. Sci., Vol. 48(4), 283-288; 2011*

[16] Shahrin, S., Roni, M. Z. K., Taufique, T., Mehraj, H. & Jamal Uddin, A. F. M. (2015). Study on flowering characteristics and categorization of rose cultivars for color, fragrance and usage. Journal of Bioscience and Agriculture Research 04(01): 20-30.

[17] Hussain, A. and M. A.Khan. 2004. Effect of growth regulators on stem cutting of Rosa bourboniana and Rosa gruss-an-teplitz. Int. J. Agric. Biol., 6:931-32.

[18] Qasim, M., I. Ahmed and T. Ahmed. 2008. Optimizing fertigation frequency for Rosa hybrida. Pak. J. Bot., 40(2):533-45.

[19] Manjula, G. M. 2005. Performance of Rose Cultivars Under Naturally Ventilated Ploy house. M.Sc. thesis, Univ. of Agric. Sci. Dharwad, India.

[20] Ramzan A., Hanif M. and Tariq S. 2014. Performance of Rosa hybrida cultivars under agro-climatic conditions in Islamabad, Pakistan. J. Agric. Res., 52(1):153- 159

[21] Lammerts, W.E. 1945. The scientific basis of rose breeding. Am. Rose Ann. 30:71- 79.

[22] Crane, M.B. and W.J.c . Lawerce .1956.The genetics of Garden plants .Macmillan, Co. Ltd., N. y.

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