

MEAN PERFORMANCE AND RANGE FOR QUANTITATIVE AND QUALITATIVE TRAITS IN GARLIC (*Allium sativum* L.)

*CHOTALIYA, P. S.; KULKARNI, G. U.; PANELIYA, M. R. AND JALU R. K.

DEPARTMENT OF GENETICS AND PLANT BREEDING
COLLEGE OF AGRICULTURE
JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH – 362 001, GUJARAT, INDIA

*EMAIL: poojachotaliya72@gmail.com

ABSTRACT

An experiment was conducted to assess the mean performance and range value in 156 genotypes and 4 checks of garlic grown in Augmented Randomized Block Design at Vegetable Research Station, Junagadh Agricultural University, Junagadh during rabi 2015-2016. The observations were recorded on 21 characters viz., plant height (cm), number of leaves per plant, leaf length (cm), leaf width at middle portion (cm), days to maturity (days), pseudostem height (cm), collar thickness (cm), bulb collar diameter (cm), bulb equatorial diameter (cm), bulb polar diameter (cm), bulb weight (g), number of cloves per bulb, clove weight (g), clove length (cm), clove polar diameter (cm), clove equatorial diameter (cm), total soluble solids (%), bulb yield (kg/ha), anthocyanin pigmentation, bulb shape and bulb colour. Based on mean values with respect to characters, the genotype RGP 447 was the higher yielder followed by RGP 108, RGP 56, JGP 183 and RGP 384. The genotype RGP 447 was the top genotypes for the economic trait such as bulb weight. These genotypes might be utilized in further breeding programme for improvement in bulb yield.

KEY WORDS: Bulb, Clove, Garlic, Range

INTRODUCTION

Garlic (*Allium sativum* L.) is one of the most important remunerative bulbous spice and medicinal crop grown commercially. It is the second most widely used spice after onion. It belongs to family *Alliaceae* because of its superior ovary and scapose umbellate inflorescence. The name garlic is derived from the old English word "gar" meaning spear presumably referring to clove. *Allium longicupis* is considered to be its wild ancestor, which is extensively found in Central Asia. Garlic (*Allium sativum* L.) has $2n=2x=16$ chromosome number. Garlic is a perennial plant, cultivated mainly for

bulbs. The edible underground stem is the composite bulb made up of numerous smaller bulbs called clove. Leaves had solid thin blades. Some varieties produce flowers but these flowers do not set seeds. There are some varieties which produce vegetative bulbs on the top called bulbils used also for propagation in some cases. Garlic is rich in protein, phosphorus, potash, calcium, magnesium and carbohydrates. The uninjured bulb contains a colourless, odourless water soluble amino acid Allin. On crushing the garlic bulb the enzyme allinase breaks down Allin to produce allicin of which the principle ingredient is the

odoriferous diallyl disulphide. Garlic contains about 0.1 per cent volatile oil. The chief constituents of the oil are diallyl disulphide (60%), diallyl trisulphide (20%), allylpropyl disulphide (6%), a small quantity of a diethyl disulphide and probably diallyl polysulphide (Pandey and Bhonde, 1997). In any crop improvement programme, basic information with respect to variability present in the crop is essential. Yield being a complex trait, is collectively influenced by various component characters, which are polygenically inherited and highly influenced by environmental variations.

MATERIALS AND METHODS

One hundred and fifty six genotypes and four checks of garlic were sown in Augmented Randomized Block Design (ARBD) (Federer, 1956) during *rabi* 2015-16. The cloves were planted at a distance of 15 cm row to row and 10 cm plant to plant as per spacing. Other recommended agronomical practices and plant protection measures were followed for the successful raising of the crop. The observations were recorded on various quantitative characters viz., plant height (cm), number of leaves per plant, leaf length (cm), leaf width at middle portion (cm), days to maturity (days), pseudostem height (cm), collar thickness (cm), bulb collar diameter (cm), bulb equatorial diameter (cm), bulb polar diameter (cm), bulb weight (g), number of cloves per bulb, clove weight (g), clove length (cm), clove polar diameter (cm), clove equatorial diameter (cm), total soluble solids (%) and bulb yield (kg/ha), and qualitative characters viz., anthocyanin pigmentation, bulb shape and bulb colour were recorded on five randomly selected competitive plants per genotype in each plot for the purpose of recording observations on different characters (except days to maturity) and their averages were used in the statistical analysis. Days to maturity was measured on plot basis.

RESULTS AND DISCUSSION

In the present investigation, based on range wise grouping of garlic genotypes are made for 16 characters (Table 1 and Figure 1). Out of 160 genotypes, 33 genotypes were short, 126 genotypes were medium and remaining one genotype was tall in plant height. Among the 160 genotypes, 88 had few leaves, 68 genotypes had medium leaves and 4 genotypes had many leaves. Among the 160 genotypes, 30 genotypes had short, while 83 genotypes had medium, and 47 genotypes had longer leaf length. Out of 160 genotypes, 44 genotypes were early, 87 genotypes were medium and remaining 29 genotypes were late in maturity. Out of 160 genotypes, 78 genotypes had short, 73 genotypes had medium and 9 genotypes had long pseudostem height. Out of 160 genotypes, 20 genotypes had short, 123 genotypes had medium and 17 genotypes had long bulb collar diameter. Among all the 160 genotypes, 19 genotypes had short, while 107 genotypes had medium and 34 genotypes had long bulb equatorial diameter. Out of 160 genotypes, 4 genotypes were short, 105 genotypes were medium and remaining 51 genotypes were tall in bulb polar diameter. Out of 160 genotypes, 48 genotypes had low, 100 genotypes had medium and remaining 12 genotypes were high in bulb weight. 57 genotypes had few cloves, 94 genotypes had medium and remaining 9 genotypes had many cloves per bulb. With respect to clove weight, 159 genotypes had low clove weight and one genotype was high in clove weight. Out of 160 genotypes, 39 genotypes had low, 99 genotypes had medium and 22 genotypes had high total soluble solids. Out of 160 genotypes, 61 genotypes had low, 90 genotypes had medium and remaining 9 genotypes were high bulb yield. Out of 160 genotypes, 101 genotypes were strong in pigmentation, 54 genotypes were weak in pigmentation and remaining 5 genotypes

(RGP 300, RGP 302, RGP 428, RGP 436 and JGP 257) had no pigmentation. In bulb shape, 99 genotypes were recessed in shape, 2 genotypes (RGP-518, JGP-21) were flat in shape and remaining 59 genotypes were round in shape. Of total genotypes, 115 genotypes were white, 26 genotypes were yellowish white, 15 genotypes were reddish white and remaining 4 genotypes (RGP 103, RGP 487, RGP 495 and JGP 58) were purple in bulb colour. The range in mean values, an indicator of variability revealed high variation for bulb yield, plant height, number of cloves per bulb, clove weight, and weight of bulb.

Based on the highest mean values with respect to different characters (Table 2), the genotype RGP 447 (6920.00 kg/ha) was the higher in bulb yield. The genotype RGP 447 (13.80 g) was also among the top genotypes for the economic trait such as bulb weight. The genotype RGP 495 (54.60 cm) had the highest plant height. The genotypes RGP 365 (11.80) and RGP 384 (11.80) had the highest number of leaves per plant. The genotype JGP 172 (35.60 cm) had the highest leaf length. RGP 224 (1.62 cm) genotype had highest leaf width at middle portion. The genotype RGP 230 (102.80 days) was the top genotypes for the days to maturity. The genotype RGP 56 (8.50 cm) had the highest pseudostem height. The genotypes JGP 148 (0.74 cm) had the highest collar thickness. The genotypes RGP 230 and RGP 447 (0.77 cm) were the top genotypes in bulb collar diameter. The genotypes RGP 52 (3.42 cm), RGP 197 (3.06 cm), JGP 185 (15.40) were the top genotypes in bulb equatorial diameter, bulb polar diameter and number of cloves per bulb, respectively, while the genotypes RGP 52 (2.02 g), RGP 405 (2.44 cm), RGP 405 (2.50 cm) and RGP 108 (1.50 cm) were among the top genotypes for the economic traits such as clove weight, clove length, clove polar diameter and clove equatorial

diameter, respectively. The genotypes RGP 384 and JGP 152 (38.90 %) had the highest total soluble solids. These results are in broad conformity to earlier researchers Vijay (1990), Thakur *et al.* (1997), Agrawal and Tiwari (2004), Singh and Chand (2004), Futane *et al.* (2006), Zahedi *et al.* (2007), Singh *et al.* (2012), Mishra *et al.* (2013), Esho (2015), Kumar *et al.* (2015) and Sharma *et al.* (2016) These genotypes might be utilized as potent parents in a breeding programme for improving bulb yield and its components.

CONCLUSION

Based on mean values with respect to different characters, the genotype RGP 447 was the higher yielder followed by RGP 108, RGP 56, JGP 183 and RGP 384. The genotype RGP 447 was the top genotypes for the economic trait such as bulb weight. These genotypes might be utilized in further breeding programme for improvement in bulb yield.

REFERENCES

- Agrawal, A. and Tiwari, R. S. (2004). Genetic variability in garlic. *Indian J. Agric. Sci.*, **74**: 164-165.
- Esho, K. B. (2015). Performance of genetic parameters in garlic (*Allium sativum* L.). *Res. J. Agric. Env. Sci.*, **2**(2): 5-9.
- Federer, W. T. (1956). Augmented designs with one-way elimination of heterogeneity. *Biometrics*, **17**(3): 447-473.
- Futane, N. W.; Jogdande, N. D.; Gange, V. S.; Garade, A. D. and Khandagale, S. S. (2006). Evaluation of garlic (*Allium sativum* L.) genotypes. *Int. J. Agric. Sci.*, **2**: 4-5.
- Kumar, Satesh; Samnotra, R. K.; Kumar, Manoj and Khar, Shilpi. (2015). Character association and path analysis in garlic (*Allium spp.*) germplasm under subtropical

- environment of Jammu. *The Bioscan*, **10**(4): 1997-2003.
- Mishra, R. K.; Prasad, K.; Pandey, S. and Gupta, R. P. (2013). Evaluation of garlic accessions for growth, yield, quality and resistance to *Stemphylium* blight disease in northern India. *Vegetos*. **26** (2): 291-296.
- Pandey, U. B. and Bhonde, S. R. (1997). Garlic Cultivation in India. *Tech. Bull.* 7: 38.
- Sharma, R. V.; Omotayo, K.; Malik, S.; Kumar, Mukesh and Sirohi, A. (2016). Character association and path analysis in garlic (*Allium sativum* L.). *The Bioscan*, **11**(3):1931-1935.
- Singh, R. K.; Dubey, B. K. and Gupta, R. P. (2012). Studies on variability and genetic divergence in elite line of garlic. *J. Spices Aromatic Crops*, **21**(2): 136-144.
- Singh, Y. and Chand, R. (2004). Genetic variability in garlic (*Allium sativum* L.). *Hort. Soc. Haryana*, **33**: 146-147.
- Thakur, J. C.; Bhathal, G. S. and Gill, S. P. S. (1997). Genetic variability and correlation studies in garlic. *J. Res. PAU*, **34**(1): 40-44.
- Vijay, O. P. (1990). Note on genetic variability in garlic (*Allium sativum* L.). *Indian J. Hort.*, **47**: 431-433.
- Zahedi, B.; Kashi, A.K.; Zamani, Z.; Mosahebi, G. H. and Hassani, M. (2007). Evaluation of Iranian garlic (*Allium sativum* L.) genotypes using multivariate analysis method based on morphological characteristics. *Biotechnol.*, **6**(3): 353-356.

Table 1: Range wise grouping of garlic genotypes of sixteen characters

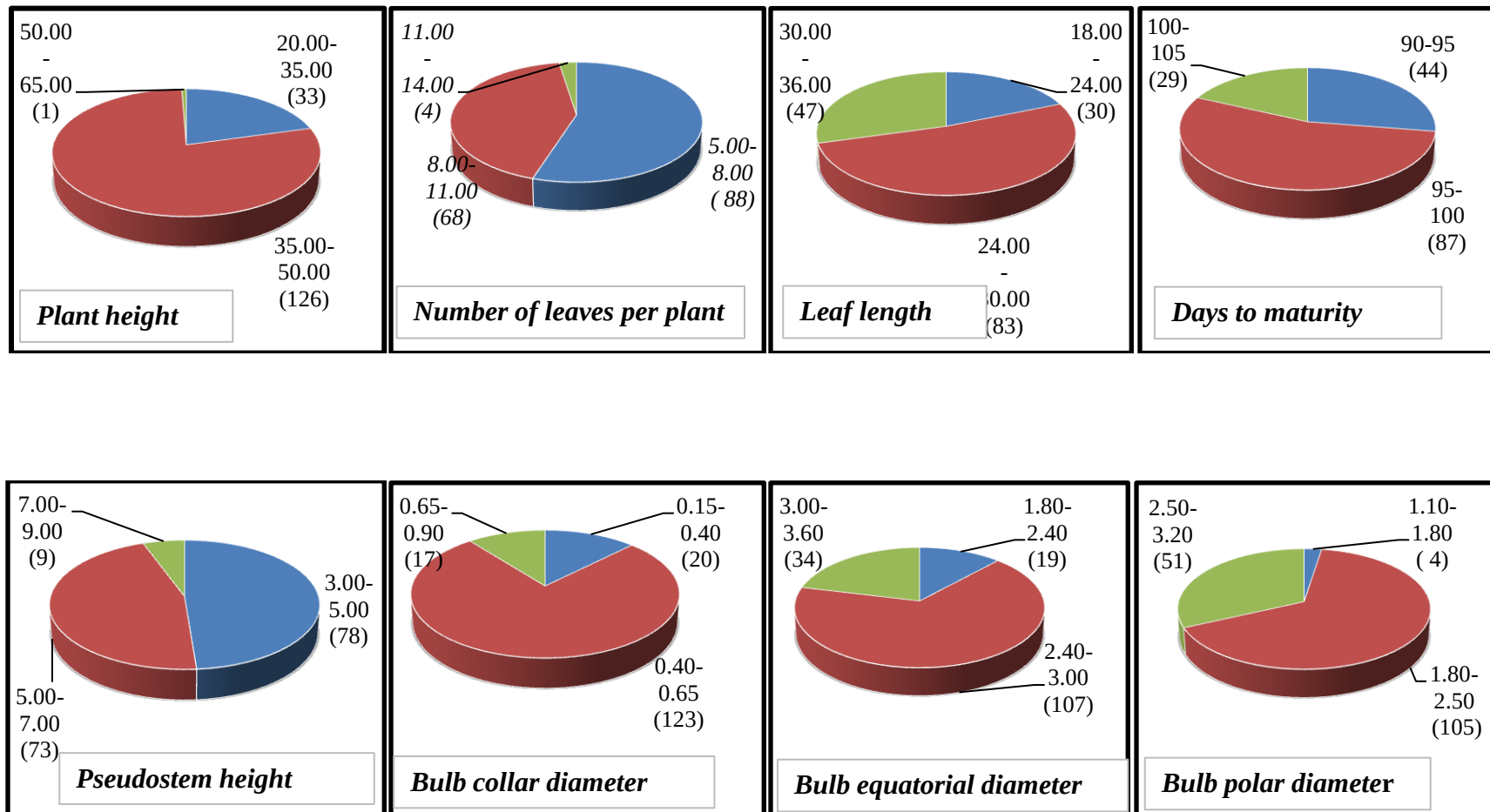
Sr. No.	Characters	Range	States*	Number of Genotypes
1	Plant height (cm)	20.00-35.00	Short	33
		35.00-50.00	Medium	126
		50.00-65.00	Tall	1
2	No. of leaves per plant	5.00-8.00	Few	88
		8.00-11.00	Medium	68
		11.00-14.00	Many	4
3	Leaf length (cm)	18.00-24.00	Short	30
		24.00-30.00	Medium	83
		30.00-36.00	Long	47
4	Days to maturity (days)	90-95	Early	44
		95-100	Medium	87
		100-105	Late	29
5	Pseudostem height (cm)	3.00-5.00	Small	78
		5.00-7.00	Medium	73
		7.00-9.00	Long	9
6	Bulb collar diameter (cm)	0.15-0.40	Small	20
		0.40-0.65	Medium	123
		0.65-0.90	Large	17
7	Bulb equatorial diameter (cm)	1.80-2.40	Small	19
		2.40-3.00	Medium	107
		3.00-3.60	Large	34
8	Bulb polar diameter (cm)	1.10-1.80	Small	4
		1.80-2.50	Medium	105
		2.50-3.20	Large	51
9	Bulb weight (g)	1.00-5.00	Low	48
		5.00-10.00	Medium	100
		10.00-15.00	High	12
10	No. of cloves per bulb	4.00-8.00	Few	57
		8.00-12.00	Medium	94
		12.00-16.00	Many	9
11	Clove weight (g)	0.00-1.00	Low	159
		1.00-2.00	Medium	0
		2.00-3.00	High	1
12	Total soluble solids (%)	30.00-34.00	Low	39
		34.00-38.00	Medium	99
		38.00-42.00	High	22
13	Bulb yield (kg/ha)	550.00-2850.00	Low	61
		2850.00-5150.00	Medium	90
		5150.00-7450.00	High	9
14	Anthocyanin pigmentation	---	Strong	101
		---	Weak	54
		---	No	5
15	Bulb shape	---	Recessed	99
		---	Flat	2
		---	Round	59
16	Bulb colour	---	White	115
		---	Yellowish white	26
		---	Reddish white	15
		---	Purple	4

*As per DUS descriptor

Table 2: Best five genotypes with respect to different characters compared with check

Characters	Genotypes	Check
Bulb yield (kg/ha)	RGP 447 (6920.00 kg/ha) RGP 108 (6520.00 kg/ha) RGP 56 (6210.00 kg/ha) JGP 183 (5850.00 kg/ha) RGP 384 (5760.00 kg/ha)	G 282 (2493.85 kg/ha)
Bulb weight (g)	RGP 447 (13.80 g) JGP 185 (12.80 g) RGP 405 (12.20 g) RGP 475 (12.00 g) RGP 56 (11.80 g)	G 282 (5.63 g)
Plant height (cm)	RGP 495 (54.60 cm) JGP 265 (49.20 cm) RGP 538 (48.80 cm) RGP 119 (47.40 cm) RGP 384 (47.00 cm)	G 282 (38.81 cm)
Number of leaves per plant	RGP 365 & RGP 384 (11.80) JGP 70 & RGP 108 (11.60) JGP 71 (11.00) RGP 447 (11.00) RGP 337 (11.00)	G 282 (8.25)
Leaf length (cm)	JGP 172 (35.60 cm) JGP 265 (34.68 cm) JGP 70 (34.10 cm) JGP 183 (33.80 cm) JGP 72 (33.60 cm)	G 282 (27.60 cm)
Leaf width at middle portion (cm)	RGP 224 (1.62 cm) JGP 143 (1.58 cm) JGP 148 (1.54 cm) JGP 183 (1.50 cm) JGP 96 (1.48 cm)	G 282 (1.13 cm)
Days to maturity (days)	RGP 230 (102.80 days) JGP 12 & RGP 222 (102.40 days) RGP 518 (102.20 days) JGP 183 (102.00days)	GG 4 & GJG 5 (95.08 days)
Pseudostem height (cm)	RGP 56 (8.50 cm) RGP 538 (8.06 cm) RGP 35 (7.94 cm) RGP 108 (7.70 cm) RGP 165 (7.50 cm)	G 282 (5.36 cm)
Collar thickness (cm)	JGP 148 (0.74 cm) RGP 538 (0.73 cm) JGP 144 (0.72 cm) RGP 173 (0.71 cm) JGP 183 (0.70 cm)	G 282 (0.53 cm)

Bulb collar diameter (cm)	RGP 230 & RGP 447 (0.77 cm) RGP 119 (0.75 cm) RGP 173 (0.74 cm) RGP 228 (0.73 cm) RGP 56 (0.73 cm)	G 41 (0.47 cm)
Bulb equatorial diameter (cm)	RGP 52 (3.42 cm) RGP 384 (3.36 cm) RGP 405 (3.32 cm) RGP 475 (3.28 cm) RGP 447 (3.28 cm)	G 41 (2.65 cm)
Bulb polar diameter (cm)	RGP 197 (3.06 cm) RGP 103 (2.96 cm) RGP 228 (2.92 cm) RGP 224 (2.86 cm) RGP 108 (2.84 cm)	G 41 (2.24 cm)
Number of cloves per bulb	JGP 185 (15.40) JGP 265 (14.20) JGP 183 (13.60) RGP 56 (13.00) JGP 72 (13.00)	G 282 (9.74)
Clove weight (g)	RGP 52 (2.02 g) JGP 17 (0.53 g) JGP 51 (0.53 g) RGP 115 (0.52 g) RGP 108 (0.52 g)	G 41 (0.35 g)
Clove length (cm)	RGP 405 (2.44 cm) JGP 72 & RGP 108 (2.42 cm) RGP 384 (2.34 cm) JGP 144 (2.32 cm) RGP 447 (2.30 cm)	G 41 (1.77 cm)
Clove polar diameter (cm)	RGP 405 (2.50 cm) JGP 72 (2.46 cm) RGP 384 (2.40 cm) RGP 366 (2.38 cm) RGP 447 (2.36 cm)	G 41 (1.84 cm)
Clove equatorial diameter (cm)	RGP 108 (1.50 cm) RGP 337 & RGP 32 (1.34 cm) RGP 115 (1.30 cm) JGP 183 (1.28 cm) RGP 366 (1.26 cm)	G 41 (0.96 cm)
Total soluble solids (%)	RGP 384 & JGP 152 (38.90 %) GG 3 (38.80 %) RGP 498 (38.70%) JGP 97 (38.60%) JGP 264 (38.50%)	GG 4 & GJG 5 (37.50%)



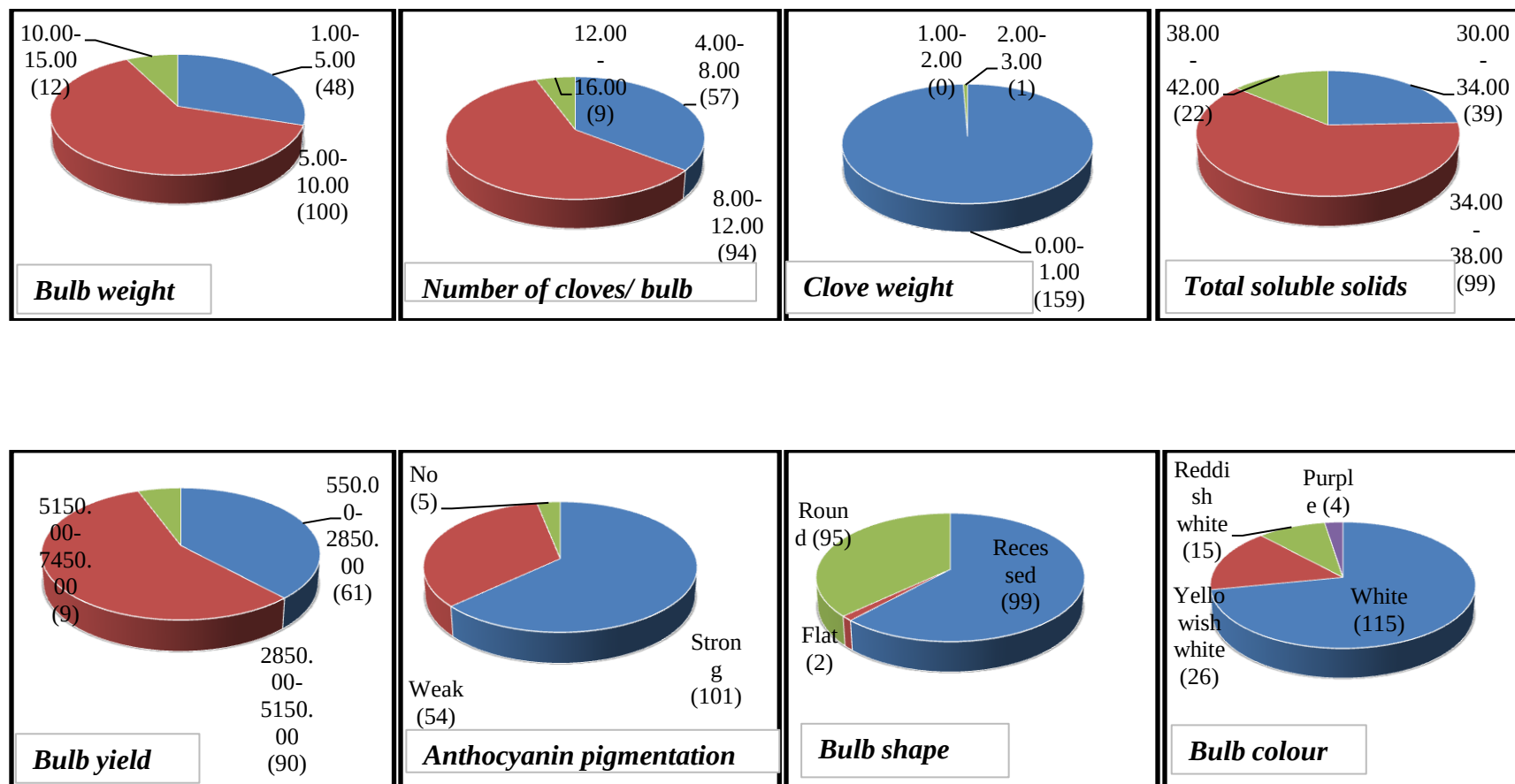


Figure 1: Range wise grouping of garlic genotypes of sixteen characters

[MS received : August 02, 2017]

[MS accepted : September 09, 2017]