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Effect of date of planting and varieties on growth, yield and storability of rabi onion (*Allium cepa* L)

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Abstract
Onion varieties were evaluated with different date of planting (15th Dec, 30th Dec, 15th January & 30th January) for adoptability to the climatic conditions of Bihar. Seedlings of two varieties of onion were planted under factorial randomized block design with three replications at research farm of Nalanda College of Horticulture, Noorsarai, Nalanda (Bihar). The quantitative data on yield and other morphological characters of onion were collected. Both the varieties were harvested at their maturity (80% top down) and then graded, weighted into two categories of bulb; marketable weight and total weight. Inferential and descriptive statistical methods were used for data analysis where by two ways analysis of variance and ranking scale were applied. It was concluded that all the two varieties namely Agrifound light red and Patna red performed differently to the total yield, marketable yield. Onion variety ALR produced the highest marketable yield i.e. 220.489 q/ha coupled with 30th December date of planting. So the farmers can be motivated for adoption of ALR with most suitable planting date i.e. 30th December for commercial production.

Keywords: Onion varieties, date of planting, growth, yield and storability of rabi onion

Introduction
Onion (*Allium cepa* L) crop of Alliaceae family believed to have its origin in Asia continent. Onion is grown throughout the world for its pungency and nutritive values. Onion exhibit particular diversity in the eastern Mediterranean countries, through Turkmenistan, Tajikistan to Pakistan and India, which are the most important sources of genetic diversity and believed to be centre of origin (Brewster, 2008) [2]. India is the second largest producer of the onion in the world, next after China. In India, Onion is being grown in an area of 0.83 million hectares with production of 13.57 Million tonnes and the productivity is 16.30 t/ha, which is low. Onion is a major spice in diet. It ranks as the 2nd most important vegetable based on the level of consumption and other uses. The growth and yield of cultivated Onion plants are mainly influenced by two principle factors viz., genetical make up of genotypes, environmental, cultural and managemental factor. The first factor deals with various breeding techniques and genetical modification for the improvement in crop varieties. The second factor deals with availability of light, temperature, humidity and agronomical practices viz., planting dates, spacing, fertilizers, irrigation, plant protection and weed control etc. A cultivar crop performs differently under different agro-climatic conditions and various cultivars of the same species grown even in the same environment give different yields as the performance of a cultivar mainly depends on the interaction of genetic makeup and environment (Jilani & Ghafoor, 2003; Kimani *et al*. 1993; Ijoyah *et al* 2008) [6, 8, 5] conducted a field experiment to evaluate the yield performance of four onion varieties and found that some other varieties performed better than the commonly grown onion varieties by the farmers. (Shah, *et al.* 2012) [14] conducted an evaluation trial on three onion cultivars in Randomized Complete Block Design having three replications and concluded that onion cultivar performed differently and Parachinar local variety resulted in higher yield. However, efforts are still continue in this direction to gain further higher yield with good quality. Onion productivity could be increased substantially through use of improved cultivars coupled with optimum date of planting.

Date of planting is also one of the important factors, which influences the growth, yield and storability of crop as a climatic factor. So, planting at different dates, to test the suitable dates for good bulb production should be standardize. Sowing of seeds and transplanting time of seedling is different from region to region. In North India sowing time of nursery is October to the middle of November and transplanting time of seedlings is from middle of December to January. While in Maharashtra, October is the sowing time of nursery and transplanting done in November for *Rabi season.*

However, one of the major problems to its production is improper agronomic practice used by farmers. The adoption of agronomic management has an undoubted contribution in increasing crop yield. The optimal use of agronomic practice such as planting time, harvesting date, suitable variety in varies environment and purpose should be standardised. Thus it very difficult to give general recommendations that can be applicable to the different agro-ecological zone (Upper Awash Agro-Industry enterprises 2001) [16] where major growing area of onion. So that to optimise onion productivity, full package of information is required (Gupta *et al*. 1994; Lemma Shimeles, 2003) [4, 10].

Materials and methods

The experiment was conducted during Rabi seasons of 2011-12 and 2012-13, at experimental farm of Nalanda College of Horticulture, Noorsarai, Nalanda. The experimental site is located from 65 km of Patna at the latitude and longitude of 25.2622^0N and 85.4788^0E, respectively. The treatments consisted of four dates of planting as factor-A and two varieties viz., Agrifound light red and Patna Red as factor-B. The treatments were laid out in a factorial randomized block design with three replications. In both experiments seedling of Agrifound light red (ALR) and Patna Red (PR) were raised in nursery beds for 7 weeks before transplanting. The nursery was prepared by constructing raised seed beds to which adequate quantities of well rotten farm yard manure (FYM) was applied. 100gm of onion seed were sown on seed beds (size 3x0.75m) in lines spaced at 5cm distance and lightly covered with a thin layer of compost and dry soil. The beds were then covered with paddy mulch and the watered lightly. The mulch was removed as soon as the seed germinated in order to expose them to sunlight. Watering was sustained lightly but regularly until the seedling was ready for transplanting seven weeks later. The experimental field was cleaned, ploughed, harrowed and raised beds of size 3.6 x 1.8 m (6.5 m^2) were constructed. Transplanting of the healthy seedling into the raised beds was done on 15 December, 30 December, 15 January and 30 January in 2011-12 and 2012-13.

The transplanted seedling was watered immediately to minimize transplanting shock. NPK @ 125:60:80 kg/ha were applied to the all experimental plots. Whole quantity of phosphorus, potash and half of nitrogen were also applied as basal dressing and rest of nitrogen were applied in two equal doses at 30 and 45 days after transplanting as top dressing. The plots were kept weeds free throughout the experimental period. The hand weeding was done as and when required. While, pests were kept under control by Appling Decis and Saaf @ 2ml and 2gm per litter of water, respectively. Data was recorded on the plant height, number of leaf per plant, neck thickness, polar & equatorial diameter, maturity days and onion bulb yield. Collected data was analysed using factorial randomized block design.

Results and discussion

It is evident from the data presented in Table-1 that effect of date of planting and varieties individually shows statistical significant result on all the traits except varietal performance on plant height and bolting. While, interaction of different date of planting and varieties did not shows significant difference during comparing the treatments in respect of growth and yield attributing characters in any of the experimental years, therefore, data of interaction are not presented here.

Maximum plant height i.e. 48.53 cm was recorded with the D_3 (15^{th} January) planting followed by D_2 (30^{th} December) planting i.e. 48.32 cm which was *at par* in both the years of experiment. This might be due to better availability of nutrient, air, water and photoperiodism and optimum utilization of plant and overall suitable climatic conditions which helps to individual plants to utilize the climatic conditions more efficiently as compare to other date of planting. Similar finding had been reported by (Khan *et al*. 2003; Jilani *et al*. 2010) [9, 7].

Maximum number of leaves i.e. 6.17 which has significantly higher was recorded with V_2-ALR while, minimum i.e.5.83 was recorded with V_1-PR, it might be due to genetical makeup and suitability of varieties in particular climatic condition. Consequently, maximum number of leaves per plant i.e 6.47 was recorded with D_3-15^{th} January followed by D_2-30^{th} January i.e. 6.28 while, minimum leaves per plant was observed with D_2-15^{th} December planting. This might be due to photoperiodism and better availability of light, nutrients, air and water which helps to plant for better growth and development.

Minimum bolting was recorded with V_2- ALR (0.50) which was statistically *at par* with V_1 – Patna red, while, it was observed minimum with D_4(30^{th} January planting) and maximum bolting was observed in D_1(15^{th} December) planting. This earlier bulb formation might have occurred and thus may received more induction, which resulted into higher number of bolter, (Nandpuri, 1990) [12] had also reported similar observation while working with kharif onion crop.

The maximum bulb yield was recorded with the plants planted on 30^{th} December i.e. (241.18 q/ha) (Fig.1) which was significantly superior to the rest of planting dates. Early planting of onion (15^{th} December) produced lowest bulb yield i.e. (204.24 q/ha) Table-1. This could be because of suitable time of planting, provide favourable climatic condition for bulb development and genetic makeup and vigour of Agrifound light red variety provide good size, better growth and development of individual plants. Similar findings had been reported by (Mohanty *et al*. 1990; Singh and Korla, 1991; Rajas *et al*. 1999; Verma *et al*. 1993; Bijaya devi *et al*. 2008). [11, 15, 13, 17, 3] Onion variety Agrifound Light red produced higher bulb yield of 220.48 q/ha which was *at par* with Patna Red (213.32 q/ha).

The onion variety V_2-ALR showed (Fig-2) minimum decay loss (13.84 %), sprouting (7.74 %) and draig (4.27 %) as compare to V_1-Patna red. It might be due to better storability of bulbs. On the account of different date of planting, minimum decay loss (13.98%), sprouting (7.53 %) and draige (3.45 %) was recorded with D_2-30^{th} December of planting. While, maximum decay loss (17.73 %), and draig (6.13 %) was observed in D_3-30^{th} January planting. The maximum sprouting (10.67%) was recorded with D_1-15^{th} December significantly *at par* (10.35%) with D_4-30^{th} January. The similar pattern has also been reported by (Ahmed, 2003) [1].

Conclusion

It was concluded that all the two varieties namely Agrifound light red and Patna red performed differently in respect of total and marketable bulb yield. Onion variety ALR produced the highest marketable bulb yield i.e. 220.489 q/ha coupled with 30^{th} December date of planting. While, ALR recorded significantly lower decay loss (13.84%), sprouting (7.74%), draig (4.27%) and bolting (0.50%) as compared to Patna Red. So, the farmers can be motivated for adoption of ALR with most suitable planting date i.e. 30^{th} December for commercial production.

Table 1: Effect of planting date on growth, yield and storability of *rabi* onion (*Allium cepa* L).

Treatments	Plant ht. (cm)	Leaves/ plant	Bulb yield (q/ha)	Decay loss (%) (upto Sept.)	Sprouting (%)	Draig (%)	Bolting (%)
V1-PR	46.17	5.83	213.32	17.47	11.15	5.43	0.53
V2-ALR	47.70	6.17	220.48	13.84	7.74	4.27	0.50
SEm(±)	0.81	0.14	5.46	0.53	0.42	0.27	0.02
CD (P=0.05)	NS	0.30	NS	1.60	1.27	0.82	NS
D1-15 Dec. 2011	45.13	5.53	204.24	14.53	10.67	5.77	0.77
D2-30 Dec. 2011	48.32	6.28	241.18	13.98	7.53	3.45	0.54
D3-15 Jan. 2012	48.53	6.47	217.03	16.37	9.23	4.06	0.38
D4-30 Jan. 2012	45.77	5.70	205.13	17.73	10.35	6.13	0.36
SEm(±)	1.11	0.20	7.47	0.75	0.59	0.38	0.02
CD (P=0.05)	2.26	0.41	15.25	2.26	1.79	1.16	0.07

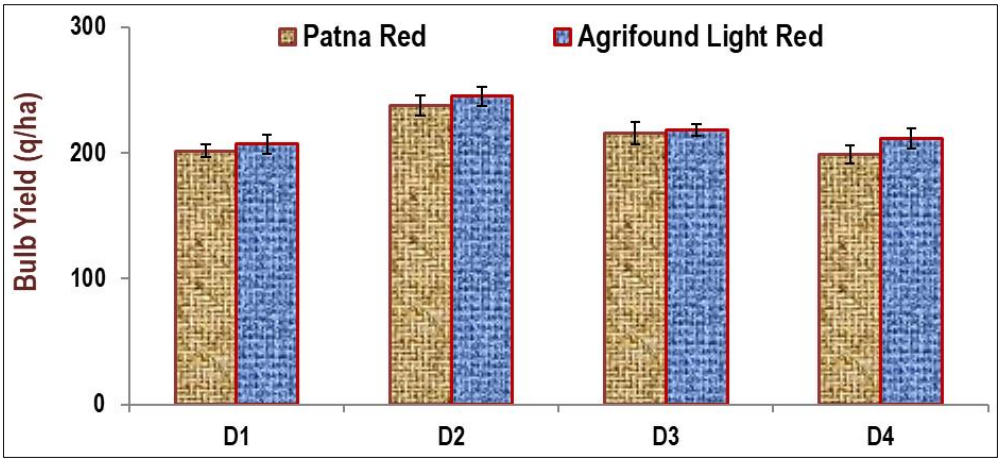

Fig 1: Effect of variety and planting date on productivity of *rabi* onion (*Allium cepa* L).

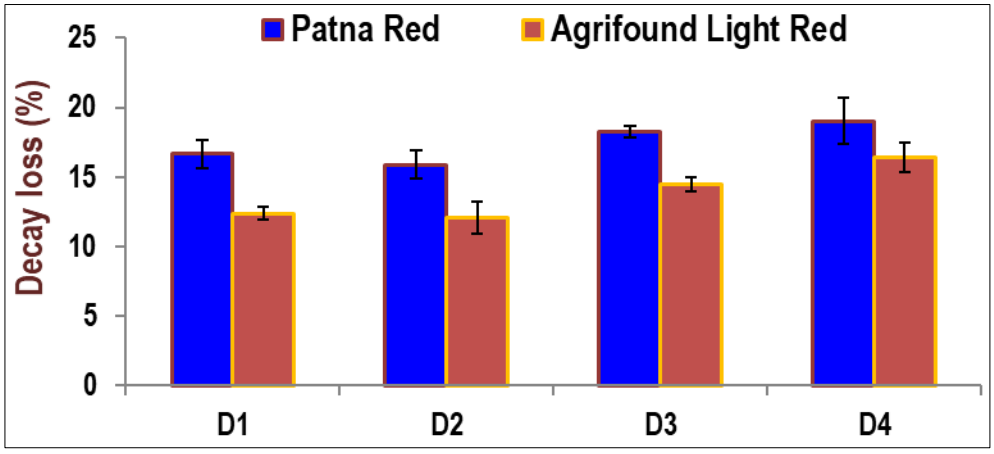

Fig 2: Effect of variety and planting date on decay loss (%) of *rabi* onion (*Allium cepa* L).

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