

Effect of Intercropping Patterns on Seed Yield and Its Attributing Parameters in Onion Seed Crop

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ABSTRACT: The present investigation entitled "Effect of intercropping patterns on seed yield and its attributing parameters in onion (*Allium cepa* L.) seed crop" was carried out at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during season of 2018-19. The experimental treatments viz., T₁-onion seed crop (sole) 60 X 60 cm, T₂-palak (sole) 15 X 5cm, T₃-methi (sole) 20 X 10 cm, T₄-onion + palak (one row) T₅- onion + palak (two rows), T₆- onion + palak (three rows), T₇- onion + palak (broadcasting), T₈- onion + methi (one row), T₉- onion + methi (two rows) and T₁₀- onion + methi (broadcasting) were laid out in a Randomized Block Design (RBD) with three replications. Based on the research investigation it was found that onion seed crop (sole crop) recorded maximum number of seeds umbel⁻¹ (1198.33), seed weight umbel⁻¹ (4.15 g), number of seeds per plant (8253.33), seed weight plant⁻¹ (26.45g) and seed yield ha⁻¹ (6.16 q ha⁻¹), which was significantly higher than rest of the intercropping treatments. The higher test weight was recorded for onion seed sole crop (3.85g) while lowest was obtained with onion + palak broadcasting (3.78 g). Within intercropping system, the number and weight of seed umbel⁻¹ were appreciably higher in onion + methi (one row) followed by onion + palak (one row). Whereas, the seed yield plant⁻¹ significantly improved in onion + palak (one row) followed by onion + methi (one row).

Keywords: Intercropping, Onion, Palak, Methi, Randomized Block Design, Yield

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops cultivated extensively in India and it belongs to family Alliaceae. Onion is considered to be the second most important vegetable crop grown in the world after tomato. Onion is an indispensable item in every kitchen as condiment and vegetable and liked for its flavour and pungency because of a volatile oil 'allyl propyl disulphide'- organic compound rich in sulphur. Its bulbs are rich source of phosphorus, calcium and carbohydrates and also contain protein and vitamin C. The beneficial compound called 'quercetin' present in onion is a powerful antioxidant. Onion is native of middle Asia and is one of the basic and most widely consumed bulb vegetable crops. The bulb crop is planted in the month of December-January and July-August as rabi and kharif seasons crop respectively in northern plain region. Seed crop is planted in the month of October at a wider spacing (60 X 60 cm). Onion contains carbohydrates (11.0 g), proteins (1.2 g), fiber (0.6 g), moisture (86.8 g) and several vitamin like vitamin A (0.012 mg), vitamin C (11 mg), thiamin (0.08 mg), riboflavin (0.01 mg) and niacin (0.2 mg) and also some minerals like phosphorus (39

mg), calcium (27 mg), sodium (1.0 mg), iron (0.7 mg) and potassium (157 mg) per 100 g [6].

India is the second largest producer and third largest exporter of onion in the world contributes around 20.2 percent of world production. In India, during 2018-2019 onion was grown over an area of 12.63 lakh hectares with a production of 234.82 lakh tonnes. Maharashtra and Karnataka are the two leading states occupying more than half of the total area and contribute nearly 46 per cent of the total production of onion in India.

Seed is the basic unit of crop production and has a greater contribution than environment and cultural factors. India needs around 9400 tons of onion seed annually for covering 12.63 lakh 2 hectare areas. The organized sector contributes around 54 per cent of the total requirement and rest is met by farmers own seed, often produced without meeting isolation requirement. There are two methods of onion seed production. Seed to seed and bulb to seed method; both can be used in seed production. But the bulb to seed is the most commonly used method in Ethiopia. It produces several stalks per bulbs hence gives higher seed yield.

Beet leaf or palak (*Beta vulgaris* var. *bengalensis*) is one of the major leafy vegetable grown and consumed in India and can be grown in tropical and subtropical regions [1]. Palak leaves are valued for their medicinal properties. Palak is short duration and widely grown leafy vegetable and can be grown throughout the year but main crop is taken as winter crop, mainly sown in October-November at spacing of 15 x 5cm. Its leaves become ready for first cutting in about 35 days after sowing and subsequent cuttings are taken at 15-20 days interval [3].

Fenugreek (*Trigonella foenum-graecum* L.), belongs to the family Fabaceae is widely distributed throughout the world. Both leaves and seeds are extensively used for medicinal purpose. Seeds of fenugreek are used locally as yellow dye in cosmetics. Fresh tender pods and leaves of fenugreek are rich in iron, calcium, vitamins A and C. Fenugreek is also used as a leafy vegetable which are rich in iron, calcium, vitamins and essential amino acids like lysine, leucine and phenyl aniline. It has high proportion of protein (20-30%) as well as amino acids. Among amino acids, 4-hydroxyisoleucine has high potential as insulin stimulating agent [8]. In Northern India it is grown during Rabi season for leaves and seed at a spacing of 20 x 10 cm. Fenugreek is a good soil renovator having property of nitrogen fixation and is widely used as green manure crop.

Intercropping refers to growing two or more dissimilar crops simultaneously on the same piece of land. Crop intensification is in both time and space dimensions. It also helps the farmers for getting stable production and maintaining the soil fertility level. Intercropping system results in yield advantage because the component crops differ in their use of growth resources. When they are grown in combination, they are able to complement each other and per se make better overall use of resources than when grown separately. Many studies have indicated that intercropping with different vegetable was more productive and profitable than sole cropping because of complementary effects of intercrop [10].

MATERIALS AND METHODS

The present study was carried out on onion sole crop & in intercrop combinations at the Vegetable Research Farm, Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during rabi season, 2018. Hisar is located at 29° 10' latitude north, 75° 46' longitude east and 215.2 m above mean sea level with semi-arid subtropical climate. A "Randomized Block Design" with

ten treatments viz., T₁-onion seed crop (sole) 60 X 60 cm , T₂-palak (sole) 15 X 5cm, T₃-methi (sole) 20 X 10 cm , T₄-onion + palak (one row) T₅- onion + palak (two rows), T₆- onion + palak (three rows), T₇- onion + palak (broadcasting), T₈- onion + methi (one row), T₉- onion + methi (two rows) and T₁₀- onion + methi (broadcasting) were laid out in a Randomized Block Design (RBD) and the treatments were replicated three times randomly with a plot size of 3.6x2.4 m. All plants received normal agricultural practices whenever they needed. In case of onion sole crop & in intercrop combinations, full recommended doses of P₂O₅ (50 kg/ha), K₂O (25 kg/ha) and ½ Nitrogen (62.5 kg/ha) were applied as basal dose and remaining quantity of nitrogen was applied as top dressing in two split doses at 30 and 60 days after transplanting. The first cutting of palak and methi leaves was done at 30 days after sowing and another two subsequent cuttings were taken at 20–25 days interval. The observations on yield parameters i.e., Number of seeds per umbel and number of seeds per plant of five randomly selected plants was harvested and their seeds were extracted. All seeds were counted and divided with number of plants to calculate seeds per plant. Seed weight per umbel (g) was calculated by dividing seed weight with number of umbels and reported as weight of seeds umbel⁻¹. Seed weight per plant (g) was estimated by dividing the weight with number of plants. The net plot area was harvested, plants were sun dried and seeds of all plants obtained from plot were threshed to record the seed yield plot⁻¹. Seed yield plot⁻¹ was weighed in kilogram and converted into quintal hectare⁻¹. One thousand seeds were counted randomly from seed lot of a plot and weighed in gram to estimate test weight.

Statistical analysis

In order to test the significance of result, standard statistical method based on the analysis of variance technique as suggested by [4] were employed. The treatments differences were compared with the critical difference (CD) at 5% level of significance to ascertain their significance; all the results have been summarized in the suitable tables presented under "Experimental Findings" given the means of treatments. Suitable Illustrations of the data have also been made at appropriate places. The critical difference (C.D.) was calculated with the help of following formula:

$$\text{Standard Error of mean (SEm } \pm) = \sqrt{VE/r}$$

$$\text{Critical difference (C.D.)} = \sqrt{2VE/r} \times 't' \text{ value at 5\% level of significance for error df.}$$

Where

C.D. = Critical Difference $VE = \text{MSS of Error (Error variance)}$

r = Number of observations averaged

' t ' = ' t ' value from fisher's table for error degree of freedom at 5% level of probability.

Analysis of variance

Source	Degrees of freedom	Sum of squares	Mean sum of squares	F calculated value
Replication	$r-1$	SSr	MSr	MSr/ MSe
Treatment	$t-1$	SSt	MSt	MSt/ MSe
Error	$(r-1)(t-1)$	SSE	MSe	
Total	$n-1$	TSS		

Where,

r = Number of replications

t = Number of treatments

MSr, MSt and MSe stand for mean sum of square due to replication, treatment and error, respectively.

RESULTS AND DISCUSSION

The number of seeds umbel^{-1} and seed weight umbel^{-1} exhibited decreasing trends with the increase in number of palak and methi rows as intercrop. The maximum number of seeds umbel^{-1} and seed weight umbel^{-1} was found in treatments onion seed crop (sole) as compared to other treatments.

Onion seed crop (sole) produced significantly higher number and weight of seeds plant^{-1} than rest of the treatments. The increased number and weight of seed plant^{-1} might be attributed to enhanced photosynthetic activity in sole crop, due to more space and less competition for nutrients which resulted in more and

accumulation of carbohydrates, increased production favorable effect on vegetative growth and retention of flowers which might have increased the number and weight of seeds plant^{-1} . The reduction in number and weight of seed plant^{-1} under intercropping treatments might be due to mutual competition among both the crops. Decreased number of seed in response to increase plant population has been reported by [5] and [2]. In intercropping system, onion + palak (one) row was at par with onion + methi (one row) and both the treatments increased appreciably higher number and weight of seeds plant^{-1} as compared to other treatments of intercropping.

Seed yield of onion decreased significantly due to palak and methi intercrops when compared with onion sole crop, which might be due to on account of higher plant population in intercropping treatments as compared to sole crop. The maximum seed yield (6.16 q ha^{-1}) was register with onion sole crop at spacing $60 \times 60 \text{ cm}$ and minimum (5.32 q ha^{-1}) was recorded with onion + methi (broadcasting). Among the different intercropping treatments onion + palak (one row) gave the maximum seed yield (5.78 q ha^{-1}), which was at par (5.76 q ha^{-1}) with onion + methi (one row) but both the treatments resulted in significantly higher seed yield when compared with rest treatments of intercropping. The higher seed yield in above treatments might be attributed to more number and weight of seeds plant^{-1} .

[7] studied the intercropping in different vegetable and they found palak have better companion effect over radish, onion and coriander in the field of brinjal taken as intercrop. The percent decrease in seed yield of onion (Table 1) due to palak and methi intercropping in various treatments ranged in between 6.17 to 13.14 per cent and 6.49 to 13.64 per cent, respectively. This might be due to

Table 1. Effect of different planting combination on seed yield of onion

Treatments	Number of seeds umbel^{-1}	Seed weight umbel^{-1} (g)	Number of seeds plant^{-1}	Seed weight plant^{-1} (g)	Seed yield (q ha^{-1})	Test weight (g)
T ₁ - Onion seed crop (Sole crop)	1198.33	4.15	8253.33	26.45	6.16	3.85
T ₄ - Onion + Palak (One row)	1158.67	3.98	7960.00	24.86	5.78	3.82
T ₅ - Onion + Palak (Two rows)	1118.33	3.82	7487.67	23.18	5.56	3.80
T ₆ - Onion + Palak (Three rows)	1109.33	3.80	7285.33	23.16	5.48	3.79
T ₇ - Onion + Palak (Broad-cast)	1103.67	3.64	6621.33	21.56	5.35	3.78
T ₈ - Onion + Methi (One row)	1165.00	3.96	7985.67	24.88	5.76	3.84
T ₉ - Onion + Methi (Two rows)	1120.07	3.80	7538.00	23.20	5.54	3.84
T ₁₀ - Onion + Methi (Broadcast)	1106.00	3.62	7029.67	21.58	5.32	3.81
SEM \pm	12.70	0.05	86.27	0.86	0.07	0.05
CD (P = 0.05)	38.51	0.14	261.66	1.64	0.21	NS

competition on onion from intercrops, leading to reduced seed yield plant⁻¹ and reflected in total seed yield. [9] reported that intercropping of radish or spinach with potato reduced potato yield by 17 per cent and 8 per cent, respectively. The fruit yield reduction of brinjal in intercropping combinations was 2.02 to 5.98 per cent as compared to sole crop [2].

CONCLUSION

The results of the experiment show that the intercropping had significant and positive influence on most of the characters. Within intercropping system, the number and weight of seed umbel⁻¹ were appreciably higher in onion + methi (one row) followed by onion + palak (one row). Whereas, the seed yield plant⁻¹ significantly improved in onion + palak (one row) followed by onion + methi (one row). The seed yield of onion was recorded maximum in onion sole crop, which was significantly higher than rest of the treatments.

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