

Original Research Article

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Effect of Intercropping on Purple Blotch (*Alternaria porri*) of Onion (*Allium cepa* L.)

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ABSTRACT

The field experiment was conducted at the Department of Plant Pathology SHUATS during the *rabi* season, to investigate the “Effect of intercropping on purple blotch (*Alternaria porri*) of onion (*Allium cepa* L.)” a legume intercrops evaluated were. Chickpea (*Cicer arietinum*), pea (*Pisum sativum*), lentil (*Lens esculantum*), french bean (*Phaseolus vulgaris*), cluster bean (*Cyamopsis tetragonoloba*), the efficacy of the legume intercrops in reducing the foliar disease was compared to a fungicide carbendazim (0.1%). each legume crop was intercropped with onion variety (Nashik red N- 53) purple blotch development were determined until physiological maturity. Legume and bulb yields were also determined at harvest. French bean was the most effective legume intercrop in reducing purple blotch incidence by up to 49.1 % and chickpea was most effective legume intercrop in increasing plant height (46.83), weight (35.53 gm) and size (5.20 cm) of onion bulb. Although intercropping onion with legume reduced bulb yield, it improved the gross return per unit area. The disease occurrence in intercrops was also recorded as a result Powdery mildew and *Alternaria* blight diseases were occurred in pea, *Alternaria* leaf spot in french bean, and disease vascular wilt in both lentil and chickpea crops was recorded. The results showed that intercropping onion with legume could be beneficial in reducing foliar disease and improving gross return per unit area. However, further studies are necessary to determine the optimal spatial arrangement of onion and legume intercrops in foliar disease management.

Keywords

Purple blotch,
Intercropping,
Onion, Legumes,
Yield

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Introduction

The onion (*Allium cepa* L.) (Latin ‘*cepa*’ = onion), also known as the bulb onion or common onion and is rightly called as “Queen of Kitchen” and is one of the oldest known and important vegetable crops grown in India. According to Vavilov 1951 the primary center of origin lies in Central Asia. Onion (*Allium*

cepa L.) is the most important bulb crop grown for human consumption world wide and it is among the most important horticultural crop (FAO STAT, 2004). The onion is native to south west Asia or Mediterranean, considered important commercial vegetable crop in the world (Wani and Taskeen, 2011).

Intercropping field vegetable with other crop species is increasing gaining popularity as a potential alternative to the use of chemicals (Trdan *et al.*, 2005, 2006). Intercropping is commonly use of vegetable crop fits into environmentally acceptable and sustainable crop production practices widely adopted by small holding farmer. This concept entails growing two or more economic species together for at least a portion of their respective productive life cycle, planting them sufficiently close to each to allow for inter specific competition (kabura *et al.*, 2008). Benefits of intercropping include optimal use of resources, stabilization of yield, weed suppression, improved soil fertility conservation and higher economic returns (Trdan *et al.*, 2011).

Purple blotch of onion caused by *Alternaria porri* is an important disease of onion worldwide except in very cool production area (Awad *et al.*, 1978; Evert and Lacy, 1990a; Brar *et al.*, 1990; Aveling *et al.*, 1993, 1994; Chaput, 1995, Cramer, 2000; Schwartz *et al.*, 2005). It is especially troublesome in warm and humid environments (Suheri and price, 2000).The fungus attacks both leaves and flower stalks (Bock, 1964), reducing foliar production by 62-92% (Suheri and Price, 2001). The disease can cause a yield loss of 30% (Everts and Lacy, 1990b) and 100% of the seed crop when the weather favours it (Daljeet *et al.*, 1992; Schwartz., 2004). Purple blotch disease of onion is important as a disease complex that nutrition (Awad *et al.*, 1978), cultural practices (Arboleya *et al.*, 2003), environmental conditions (Everts and Lacy, 1990a; Suheri and Price, 2000, 2001) and prevalence of other disease factors (Brar *et al.*, 1990) all contribute to resistance or susceptibility to the disease, thereby making it more difficult to control. The most reliable measure of control of the disease so far is through crop rotation and use resistance varieties (Delahaut and

Stevenson, 2004; Latin and Helrns, 2001) or good cultural practices (Schwartz, 2004; Allen, 2005). Intercropping bulb onion with vegetables could be beneficial in reducing foliar disease and improving gross return per unit area (Narla, 2011).

Materials and Methods

Experimental site and treatment

The field experiment on purple blotch disease of onion was carried out in research field of Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad during 2017-2018. In the present study experiment was lay out in randomized block design with 7 treatments and 3 replications. The Nashik Red N-53 variety of onion was sown in different legume intercrops (chickpea, pea, lentil, cluster bean, French bean).The size of main plot is 2.5 × 2m,Sowing ratio (intercrop + Onion + intercrop 1:2:1), Sowing of onion seed (nursery preparation) in date 15th Oct 2017. The onion seed were collected from Aloybagh, Allahabad. The onion seedlings were transplanted in the main plots at spacing of 25 × 20 cm. The intra-row spacing was 20 cm for french bean, cluster bean, pea and chickpea for lentil it was 15 cm. The control plots consist of onion with and without fungicide (Carbendazim 0.1%) applied at the rate of 0.1gm / lit. The legume intercrops were sown before transplanting the onion. The fertilizer were applied at the rate of 40 kg N /ha in intercrops only.

Symptoms of pathogen

The purple blotch symptoms on onion initially appears on leaves or inflorescence as small (2-3 mm in dia) water soaked lesions that quickly develop white centre under favourable conditions vary from small, elliptic white lesions to large, sunken purple lesions with concentric dark and light zones

Later these lesions enlarge, coalesce and turn brown to purple extending upwards and downwards (Verma and Sharma, 1999).

Methods of recording observation

Observation on disease incidence % was recorded at 60, 75 and 90 days after Sowing. Disease incidence was determined according to Abubakar (2013).

Disease incidence (%) =

$$\frac{\text{Total number of infected plants}}{\text{Total number of plants}} \times 100$$

Cost benefit ratio

The benefit cost ratio was calculated using the following formula (Reddy and Reddi, 2004).

$$\text{Cost Benefit Ratio} = \frac{\text{Gross Return (Rs/ha)}}{\text{Total cost of cultivation}} \times 100$$

Analysis of variance

The data recorded during the course of investigation was statistically analyzed among genotypes by F-test. It was carried out according to the procedure of Randomized Complete Block Design procedure for each character as per methodology advocated by Panse and Sukhatme, (1967).

Results and Discussion

The effect of intercropping on purple blotch

Result of 90 days after transplanting (DAT) indicates that significantly reduced the purple blotch disease was recorded in treatment of

carbendazim (21.84%), as compared with intercropping treatment. Onion + french bean 2:1 (49.01 %) and Onion + pea 2:1 (49.15 %), is the best treatment for controlling the purple blotch disease (Table 1). Comparing the result with C.D. value it was found that T₆ (carbendazim) was significantly superior overall treatments and among the intercrops onion + French bean was effective.

Effect of intercropping on plant height, weight, size and onion bulb yield

The maximum plant height, weight, size and yield were recorded in treatment, onion + chickpea. It was best treatment as compare to sole onion (Table 2). The reduction in bulb yield due to intercropping of onion with other legume was compensated by the additional yield from the legume crop resulting in higher gross return per hectare (Table 3).

Disease occurs in other crop plants

The disease occurrence in intercrops was also recorded as a result Powdery mildew and Alternaria blight disease were occurred in pea, Alternaria leaf spot in french bean, and disease Vascular wilt in both lentil and chickpea crops was recorded.

This study has demonstrated that legume intercrops were effective in reducing purple blotch on onion. The result of the study agree with reports by Sahile *et al.*, (2008), Who demonstrated the suppression of chocolate spot (*Botrytis fabae*) on faba bean when intercropped with field pea, barley or maize. Narla *et al.*, (2011) demonstrated the effectiveness of vegetable intercrops in the management of downy mildew and purple blotch disease. Vegetable intercropped with carrot spider plant French bean. The effect of barley-legume intercrop in an organic farming system on disease incidence was investigated.

Table.1 Effect of Intercropping on percent of disease incidence of purple blotch (*Alternaria porri*) on onion at different time intervals

Treatment	(60 DAT)	(75 DAT)	(90 DAT)
sole onion	39.45	47.19	54.20
onion + chickpea	38.50	46.96	53.04
onion + pea	36.17	43.99	49.15
onion + lentil	37.34	45.03	53.22
onion + cluster bean	36.21	44.09	52.46
onion+ french bean	34.67	43.23	49.01
Onion + Carbendazim	13.48	17.13	21.84
CD at (0.5%)	2.260	1.516	1.586

DAT: days after transplanting, CD: critical difference

Table.2 Effect of intercrops on plant height (cm), weight (gm) and size of onion bulb at different time intervals

Treatment	60 (DAT)	75 (DAT)	90 (DAT)	Wt. of bulb	Size of bulb
sole onion	24.70	31.67	36.17	25.94	2.84
onion + chickpea	32.27	39.00	46.83	35.35	5.20
onion + pea	27.13	34.13	40.27	30.45	3.94
onion + lentil	30.00	37.07	44.13	33.70	4.45
onion + cluster bean	29.03	35.27	43.20	31.59	3.91
onion+ french bean	26.47	34.07	39.07	29.35	3.87
Onion + fungicide	25.53	33.00	37.00	26.70	2.93
CD at (0.5%)	2.14	1.14	1.64	1.21	0.70

DAT: days after transplanting, WT: weight, CD: critical difference

Table.3 Average return per hectare of bulb onion in sole onion or intercropped with other legumes

Treatment	Intercrops Kg / ha	Bulb onion Kg/ ha	Gross income
sole onion	0.00	3400	51000
onion + chickpea	1768	2520	99680
onion + pea	1120	2260	61900
onion + lentil	1090	2380	84750
onion + cluster bean	1136	2280	68280
onion+ french bean	1380	2200	74000
Onion + Carbendazim	0.00	4000	63600

The legumes were lupin, faba bean and pea. Diseases were detected on pea and barley. On

pea, only ascochyta blight (*Ascochyta pisi*) was observed. When either pea variety was

intercropped with barley, the level of ascochyta blight was reduced. Net blotch (*Pyrenophora teres*), brown rust (*Puccinia recondita*) and powdery mildew (*Blumeria graminis* f. sp. *hordei*) (in order of incidence) were monitored on barley between flag leaf emergence and heading. The levels of all three diseases were reduced in every intercrop treatment compared to the barley monocrop. However, this reduction was only statistically significant in the pea treatments for neck blotch Kinane *et al.*, (2002).

Intercropping onion with the vegetable reduced both total and marketable bulb yield. This is the agreement with finding by Trden *et al.*, (2006). The reduction in yield due to intercropping of onion with other vegetables was compensated by the additional yield from the vegetable resulting in higher gross return per hectare Trdan *et al.*, (2011). The reduction in yield could have been caused by the reduction in onion population and intercrop competition for nutrients, water and light Ansari and Mamgham (2008). The reduction in bulb yield may be compensated by the yield from the vegetable intercrops and, therefore no net loss to the farmer. In addition, the intercrop may act as buffer against total crop loss and diversifies the production. therefore, the Onion-vegetable intercrops would be suitable to small scale farmers who do not have adequate resources for purchase of chemical fungicides. The system would also be very ideal for organic vegetable production in which chemical application is not desirable. Apart from increasing total farm productivity, mixed species cropping can bring many important benefits such as improvement of soil fertility management and suppression of pest and disease Ramert and Lennartsson (2002). Demonstrated the Pea intercropped with garlic, turnip, cauliflower. Observe the maximum yield loss of garlic in the pea-garlic intercrop system Anjum *et al.*, (2014).

From present study, it was concluded that intercropping of onion with french bean were found as best treatment to minimize purple blotch disease in small holder onion production systems, were as for maximum yield, bulb weight and size of bulb intercropping of onion with chickpea was found to be most effective. Since chemicals have many hazardous effects on the environment as well as on the person who handles it while application in the field and consumers using the product, so used of intercropping system in field condition would be considered as better, as it is beneficial and eco-friendly. Since, one year data is not sufficient to conclude concurrent result, further experimentations are required to confirm the results.

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