J.Mycopathol.Res. 63(4) : 885-888, 2025, ISSN : 0971-3719 (Print), 2583-6315 (Online) 10.57023/JMycR.63.4.2025.885

Effect of sowing dates and weather variables on Fusarium wilt disease of pea (*Pisum sativum* L.) in Manipur hills

MD. FAKUR AHAMAD* AND GKN CHHETRY
Department of Botany.Manipur University, Canchipur-795003,Imphal East, Manipur

Received : 26.09.2025 Accepted : 12.11.2025 Published : 29.12.2025

Field experiment at Lower Toribari, under kangpokpi district was conducted using three local varieties of pea namely Arkel, Makhyatmubi and Rachna to assess the effect of weather variables and sowing dates on wilt of pea caused by *Fusarium oxysporum* f. sp. *pisi* during rabi seasons in three consecutive years(2021-22,2022-23 and 2023-24) at fortnightly intervals viz,15th and 29th October and 12th November in each Rabi season of the year. Appearance of *Fusarium* wilt was screened after a gap of fourteen days. Weather variable such as temperature and humidity at the experimental sites varies from 21.4^{0}C to 28.4^{0}C (max.) and minimum temperature ranging from 11.2^{0}C to 15.1^{0}C.Similarly relative humidity varies from 85.9% to 93.6%(morning at 6.30am) and evening RH (Eve RH) that range from 36.5% to 41.8%. Late (12th Nov) as well as early(15th Oct) sown varieties show significant increase of disease parameters(DS) as compared to the normal date 29th October).Similar results were obtained as regard the disease parameter showing negative correlation of temperature and RH effect on Fusarium wilt. These alteration in sowing dates can act as one of the agronomic practices in controlling the disease.

Keywords : *Fusarium oxysporum*, Powdery mildew, relative humidity, rainfall, temperature

INTRODUCTION

Pea belongs to the family Fabaceae which is an important cool season, leguminous crop which is cultivated throughout the world owing to its many fold uses in daily life (Smykal *et al.* 2012). It is the second most important crop of the world because of its high yield potential and their consumption is lower in Europe than in any parts of the world (Karkanis *et al.* 2016). It occupies 459 thousand hectares in India and share 21 percent production of the world and India is the largest producer of pea in the world. Economically due to its and cash crop nature it represents 40% of the total trade in pulses. Pea is highly rich in protein content and is consumed as both i.e pulse as well as vegetable food.It has a good source of Carbohydrates vitamins A and C, calcium, phosphorus and has asmall quantity of iron.

In Manipur, pea occupies 85% of the total pulses area and is most important pulse crops grown in 26,000 ha. Manipur being a high humidity region, *Fusarium* wilt caused by *Fusarium oxysporum* f.sp.*pisi* affects the pea cultivation as it is a soil borne fungi that can survive for many years (Kripalini *et al*. 2018). The plant in its early years stage is attacked by the fungus and kills it outright but it shrivelled its grain in its later stage yielding heavy losses.

MATERIALS AND METHODS

Field experiment was carried out at Lower Toribari, Kangpokpi during the Rabi season crop of three intervening myers, 2021-2022, 2022-2023 and 2023-2024.Land preparation done by ploughing the land to depth of 30cm and disking to the depth of 15 cm in plot size of 3×3 m².Three varieties of pea namely Arkel,Makhyatmubi and Rachna susceptible to Fusarium wilt was sown on three different sowing dates in a randomized block design with three replications with a depth of 4-5 cm. The observation on the Fusarium wilt was recorded at fortnightly intervals and was continued till the maturity of the crop. Observation was recorded in terms of percent disease severity following Mayee and Datar(1986) and their effects on different climatic factors viz. Maximum and

*Correspondence : lakiberoi@gmail.com

Minimum Temperature, Morning RH and Evening RH were studied. The meteorological parameter were collected from Directorate of Environment and Climate Change,Porompat and Krishi Vigyan Kendra,Kangpokpi.The correlation between disease severity and weather variables was calculated. The relationship between disease severity and various weather variables was determined by using Karl Pearson linear correlation. Pearson correlation coefficient (r),Pearson 1896 as given below

$$r = \frac{1}{n-1}\sum \frac{\left(xi - \bar{x}\right), Y = \left(yi - \bar{y}\right)}{S_X S_y}$$

Where,r=coefficient of correlation, X= (x_i-x), Y=(y_i-2),S_x=Standard deviation of x series,S_y= Standard deviation of y series,n=number of series.

RESULTS AND DISCUSSION

Fortnightly interval data of weather parameter and disease severity of pea were calculated and presented in Table 1.In the seeds sown on 15th October,first appearance of fusarium wilt and wilting of leaves occurs in 2nd fortnightly intervals (14 DAS) and then increases with the age of the crop. Disease appearance increases faster after 2nd fortnightly intervals reaching upto 13.83% in Arkel to 11.87% in Makhyatmubi and 6.67% in Rachna.Disease severity reaches upto 28.33% in Arkel to 25.6% in Makhyatmubi and 23.7% in Rachna after 6th fortnightly intervals.Disease severity of Arkel ranges from 2.47% to 28.33%,Makhyatmubi ranges from 2.17% to 25.6% and Rachna ranges from 1.8% to 23.7% and Maximum Temperature ranges from 21.6 to 27.63,Minimum Temperature ranging from 12.2 to 14.73, Mor RH ranging from 87.2% to 92.27% and Eve RH ranges from 37.37% to 41.03% as shown in Table 1.Negative correlation exist between disease severity and Max T, Min T, Mor RH and Eve RH respectively for three varieties as shown in Table 2.

In the seeds sown on 29th October, disease severity reaches upto 24.57% in Arkel to 22.43% in Makhyatmubi and 19.53% in Rachna after 6th fortnightly intervals.Disease severity of Arkel ranges from 1.4% to 24.57%,Makhyatmubi ranges from 1.7% to 22.43% and Rachna ranges from 1.37% to 19.43% and Maximum Temperature ranges from 21.6 to 26.4,Minimum Temperature ranging from 12.06 to 14.03,Mor RH ranging from 86.9% to 91.1% and Eve RH ranges from 37.37% to 40.4% (Table 3).Negative correlation exist between disease severity and Max T,Min T,Mor RH and Eve RH respectively with regression equation for three varieties (Table 4).

In the seeds sown on 12th November, Disease severity reaches upto 32.03% in Arkel to 30.43% in Makhyatmubi and 29.93% in Rachna after 6th fortnightly intervals.Disease severity of Arkel ranges from 2.8% to 32.03%,Makhyatmubi ranges from 2.5% to 30.43% and Rachna ranges from 2.37% to 29.93% and Maximum Temperature ranges from 21.6 to 25.47,Minimum Temperature ranging from 12.07 to 13.37,Mor RH ranging from 86.93% to 88.93% and Eve RH ranges from 37.37% to 42.3% as (Table 5). Negative correlation exist between disease severity and Max T, Min T, Mor RH and Eve RH respectively with regression equation for three varieties (Table 6).

The data revealed that late sowing of crop(Nov 12th) and early sowing(15th October) has higher disease severity than the crop sown at 29th October for all the three varieties, Arkel, Makhyatmubi and Rachna.These similiar trend was followed in all the three years. Ghatak *et al.* (2014) reported that increased inoculum resulted in higher incidence of wilt .Sharma *et al.* (2024) also reported that early sowing associated with high soil temperature (22.6^{0}C) resulted in maximum wilt incidence (97.2%). It was reported by Kharte *et al.* (2022) that correlation coefficient of disease incidence of Fusarium wilt with temperature and Relative humidity showed negative correlation and is in conformity with the present findings. It can be highligted that the temperature is one of the important factors which favor the development of wilt disease and a negative correlation between disease severity and rainfall. Chhetry and Ranjana Devi (2014) also reported the negative correlation coefficient between disease severity and meteorological factors.

Table. 1: Disease Severity and environmental factors on the occurence of wilt disease of pea in three varieties of pea sown during 15th October for three years. (2021 to 2024)

Date of assessment	DS_1 (%)	DS_2 (%)	DS_3 (%)	Max T	Min T	Rh%(Mor)	RH%(Eve)	Rainfall
Oct29-Nov11	2.47	2.17	1.8	27.63	14.73	92.27	41.03	7.27
Nov12-Nov25	6.03	4.43	4	26.4	14.03	91.1	38.83	8.33
Nov26-Dec09	13.83	11.87	6.67	25.47	13.37	88.93	37.37	5.87
Dec10-Dec23	18.93	16.73	15.06	24.4	12.2	88.03	38.53	4.40
Dec24-Jan06	23.53	21.57	19.1	22.67	12.9	88.3	40.4	3.80
Jan07-Jan20	28.33	25.6	23.7	21.6	12.33	87.2	39.27	3.47

DS_1=Disease severity for Arkel,DS_2= Disease severity for Makhyatmubi,DS_3= Disease severity for Rachna.
Max T=Maximum Temperature,Min T=Minimum Temperature, Rh%(Mor)=Morning RH, RH%(Eve)=Evening RH

Table 2: Correlation coefficient(r) between disease severity and Environmental factors

Varieties	DS vsMaxT	DSvs MinT	DSvsRh%(Mor)	DSvsRH%(Eve)	DSvsRainfall
Arkel	-.987**	-.910*	-.961**	-0.137	-.949**
Makhyatmubi	-.987**	-.898*	-.951**	-0.099	-.958**
Rachna	-.984**	-.877*	-.901*	0.024	-.935**

**=significant at 1%,*=significant at 5%.

X_1=Maximum Temperature,X2= Minimum Temperature,X3=MorRH,X4=EveRH.

Table 3: Disease Severity and environmental factors on the occurence of wilt disease of pea in three varieties of pea sown during 29th October for three years. (2021 to 2024).

Date of assessment	DS_1(%)	DS_2(%)	DS_3(%)	Max T	Min T	Rh%(Mor)	RH%(Eve)	Rainfall
Nov12-25	1.4	1.7	1.37	26.4	14.03	91.1	38.83	8.33
Nov26-Dec09	3.2	3.36	3.73	25.47	13.37	88.9	37.37	5.87
Dec10-Dec23	8.26	6.36	6.1	24.4	12.2	88.03	38.53	4.40
Dec24-Jan06	14.87	12.67	12.2	22.67	12.9	88.3	40.4	3.80
Jan07-Jan20	20.1	17.2	15.53	21.6	12.33	87.2	39.27	3.47
Jan21-Feb03	24.57	22.43	19.53	23.37	12.06	86.93	39.8	3.63

DS_1=Disease severity for Arkel,DS_2= Disease severity for Makhyatmubi,DS_3= Disease severity for Rachna.Max T=Maximum Temperature,Min T=Minimum Temperature, Rh%(Mor)=Morning RH, RH%(Eve)=Evening RH

Table4: Correlation coefficient(r) between disease severity and Environmental factors

Varieties	DSvsMaxT	DSvsMinT	DSvsRH%(Mor)	DSvsRH%(Eve)	DSvsRainfall
Arkel	-.851*	-0.796	-.857*	0.693	-.837*
Makhyatmubi	-.813*	-0.763	-.836*	0.679	-0.802
Rachna	-.841*	-0.772	-.855*	0.684	-.833*

**=significant at 1%,*=significant at 5%.
X_1=Maximum Temperature,X2= Minimum Temperature,X3=MorRH,X4=EveRH.

Table 5: Disease severity and Environmental factors on the occurrence of wilt disease of pea in three varieties of pea sown during 12th November for three years (2021-2024 pooled data)

Date of assessment	DS_1(%)	DS_2(%)	DS_3(%)	Max T	Min T	RH%(Mor)	RH%(Eve)	Rainfall
Nov26-Dec09	2.8	2.5	2.37	25.47	13.37	88.93	37.37	5.87
Dec10-Dec23	7.87	7.47	6.47	24.4	12.2	88.03	38.53	4.40
Dec24-Jan06	12.63	11.5	10.17	22.67	12.9	88.3	40.4	3.80
Jan07-Jan20	17.3	16.1	15.47	21.6	12.33	87.2	39.27	3.47
Jan21-Feb03	23.77	22.07	21.2	23.37	12.07	86.93	39.8	3.63
Feb04-Feb17	32.03	30.43	29.93	23.73	12.63	88.37	42.3	3.53

DS_1=Disease severity for Arkel,DS_2= Disease severity for Makhyatmubi,DS_3= Disease severity for Rachna.
Max T=Maximum Temperature,Min T=Minimum Temperature, Rh%(Mor)=Morning RH, RH%(Eve)=Evening RH

Table 6: Correlation coefficient(r) between disease severity and Environmental factors

Varieties	DSvsMaxT	DSvsMinT	DSvsRH%(Mor)	DSvsRH%(Eve)	DSvsRainfall
Arkel	-0.422	-0.456	-0.419	0.887	-0.779
Makhyatmubi	-0.410	-0.453	-0.407	0.887	-0.773
Rachna	-0.391	-0.436	-0.394	0.877	-0.751

**=significant at 1%,*=significant at 5%.
X_1=Maximum Temperature,X_2= Minimum Temperature,X_3=MorRH,X_4=EveRH

CONCLUSION

Fusarium wilt is an important disease of pea leading to significant yield loss. Owing to its importance, agronomic practices needed to be developed to study the control measures for developing effective management practices. Thus the present investigation was done to develop a model for controlling the severity of wilt disease .

ACKNOWLEDGEMENT

Authors are grateful to the villagers of Toribari, Kangpokpi district for their appropriate help during the survey and to Manipur University for helping me carry out my research work.

DECLARATION

Conflict of Interest. The authors declare no conflict of interest.

REFERENCES

Anonymous, 2015. Annual Report (2014-15) on Promotion of Pulses in NEH region. ICAR- Indian Institute of Pulses Research, Kanpur, Uttar Pradesh 208024 (India).39 pp.

Chhetry, G.K.N., Ranjana Devi, T. 2014. Wilt epidemiology of pigeonpea (*Cajanus cajan* L. Millsp) in organic farming system. *IOSR J. Agri. Vet. Sci.* **7**:1-6

Ghatak, A.,Shukla, N.,Ansar, M.,Balodi, R., Kumar, J. 2014. Effect of sowing time,soil temperature and inoculum density on suppression of Fusarium wilt in lentil(*Lens culinaris*).*Inter. J.Biores.Stress Mgmt*. **6**:268-273.

Karkanis, A., Ntatsi, G., Kontopoulou, C.K., Pristeri, A., Bilalis, D., Savvas, D.2016 Field pea in European cropping system ,adaptability. biological nitrogen fixation and cultivation practices. *Not. Bot. Horti.Agrobot. Cluj-Napoca*.**44**:325-336.

Kharte, S., Gupta ,P.K., Gharde, Y. 2022. Role of weather parameters on development of pea diseases of central India.*Ann.Plant Protect. Sc*. **30**:33-36.

Kripalini,N. ,Bisawas, M.K.,Devi, P.S. 2018. Studies on morphological ,cultural and pathogenic variability in isolates of *Fusarium oxysporum* f. sp. *pisi* causing ilt of pea from different variety es ofManipur, India. *Int. J. Curr. Microbiol. App. Sci.* **7**:2500-2506.

Mayee,C.D.,Datar, V.V.1986.Phytopathometry .Technical Bulletin-1,Marathawad Agricultural University,Parbhani,India,146.

Sharma, S.,Ayushi, S., Megha, A., Sharma, B.K.2024. Effect of weather variables on the development of Lentil wilt caused by *Fusarium oxysporum* f. sp. lentis. *Inter.J. Plant Social Sci.***36**: 796-800.https://doi.org/10.9734/ijpss/2024/v36i64686.

Smykal, P., Aubert, G., Burstin, J., Coyne, C.J., Ellis, N.T.H.,Flavell, A.J., Ford, R., Hýbl, M., Macas, J., Neumann, P.,McPhee, K.E., Redden, R.J., Rubiales, D., Weller, J.L., Warkentin, T.D. 2012. Pea (*Pisum sativum* L.) inthe genomic era. *Agron.***2**: 74–115