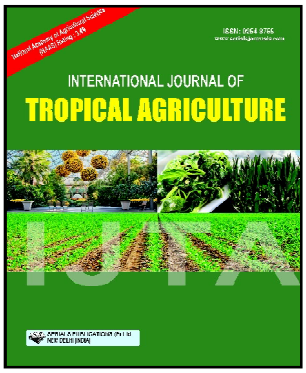

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Role of KVK Fatehabad in management of cereal cyst nematode causing molya disease in wheat : A case study

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GENERAL DESCRIPTION ABOUT THE DISTRICT FATEHABAD

Fatehabad district came into existence on july 15,1997. It was carved of Sirsa and Hisar districts. The district has three sub divisions namely Fatehabad, Tohana, Ratia and six blocks namely Fatehabad, Tohana, Ratia, Bhuna, Bhattu kalan and Jakhal. Fatehabad is located at 29.30° N & 75.27° E. It has an average elevation of 224 metres (734 feet.) This city is situated on National Highway no. 10 connecting Sirsa to Delhi, also it is connected through road network to Bhatinda, Patiala and Sangrur in Punjab. Nearest airport are Chandigarh and Delhi. Fatehabad is situated in western Haryana, Punjab in north, Hisar district in east and Rajasthan in south and Sirsa district in west surround the Fatehabad district. It has a total geographical area of 252304 hect. as of 2011 Inidan Census Fatehabad had a total population of 1883044. Males constitute 52.56% of the population and female 47.44% . The total literacy rate of the district is 67.93% . Ghaggar river is passing through northern western part of this district.

CLIMATE

The climate of Fatehabad district is very pronounced character i.e. very hot in summer and very cold during winters temperature ranges from -1 to 48 degree Celsius. Annual rainfall is 267 mm. Topography of this district is plain and sand dunes. Soils are sandy, sandy loam and clay with pH ranging from 7.5 to 9.00. In Fatehabad 56%, 36% and 8% water poor, marginal and good quality respectively.

Soil type

Name of blocks	*Soil type*	*Area in ha*
Fatehabad	i) Sandy soil	67959
	ii) Clay loam	-
	iii) Alluvial clay	-

Bhuna	Clay to sandy loam	39467
Bhattu	Sandy soil	36005
Ratia	Most of the area falls under clay loam soils being Ghaghar river area	53190
Jakhal	-do-	15283
Tohana	Clay loam to loamy soil	33624

Crops

Paddy-wheat and cotton-wheat are the main crops rotation followed in the district. The average yield of paddy, cotton and wheat are 36.90 q. ,653 lint. & 48.58 q. Per hectare respectively during the year 2015-16.The other crops grown are **guar, bajra**, oilseed and pulses. Buffalo is the main milk animal followed by cow, sheeps and goat. Horticulture and vegetable crops are cultivated in 16.80 thousand ha. in this district in year 2015-16. The Fatehabad district is gaining momentum to produce kinnows(Citrus).

Plant parasitic nematode

Plant parasitic nematode (PPN)_are very small and can only be seen by using a microscope . All plant parasitic nematode have a stylet or mouth –spear that is similar in structure and function to a hypodermic needle. The stylet is used to puncture plant cells and then inject digestive juices and ingest plant fluids. Most of the PPN that are important to crops feed on plant roots. There are about 6000 known species of phyto-parastic nematode belonging to 197 genera. PPN damage is often over looked due to mostly non specific symptom, although to those associated with more sever and easily plant damage. The extent of direct damage to plant depends on several factors. i. e

i. Initial nematode population
ii. Nematode density in soil
iii. Nature of parasitism (ectoparasite, endoparasite, migratory and sedentary)
iv. Host susceptibility
v. Cropping pattern
vi. Edaphic factors (soil, texture, moisture etc.)
vii. Ambient climatic conditions
viii. Maximum temperature and moisture

Cereal Cyst Nematode (*Heterodera avenae*)

Cereal cyst nematode is known as molya nematode of wheat & barley. This nematode is important pest of wheat & barley under Haryana conditions. Molya disease caused by *Heterodera avenae* is serious problem of wheat & barley in light sandy soil of Haryana. In Haryana CCN is present in 10 district of south western part (Palwal, Mahendergarh, Faridabad, Gurgaon, Rewari, Jhajjar, Rohtak, Hisar, Fatehabad and Sirsa). In Fatehabad district maximum soil type is sandy i.e 103964 hec. Area. The CCN infestation at 4-5 eggs and larvae / gm of soil is approximated the economic threshold level (ETL) depending on the initial population density, soil type and soil moisture conditions.

For the management of this nematode Crop rotation, resistant varieties and application of carbafuran 3G are most widely used practices. The present case study presents the work done to disseminate different technologies given by CCS HAU Hisar for the management of molya nematode (*Heterodera avenae*) in wheat in the district Fatehabad. KVK Fatehabad played a very crucial role for the management of this nematode since 2009-10 to 2015-16.

CEREAL CYST NEMATODE PROBLEMS AND ITS MANAGEMENT IN THE DISTRICT THROUGH DIFFERENT PRACTICES

Krishi Vigyan Kendra came into existence on 30^{thttt} July 2004. Krishi Vigyan Kendra, Fatehabad plays a vital role in the transfer of technology to the farmers. Some blocks i.e Bhattu, Fatehabad & Bhuna of the

district having sandy soil due to sandy nature and scarcity of water in Fatehabad. Farmers are facing problem of molya nematode in wheat and barley.

Keeping in view this problem Krishi Vigyan Kendra, Fatehabad concentrated on tremendous work, during the last seven years (2009-10 to till date). After ascertaining the training needs of farmers as well as extension functionaries the KVK, Fatehabad organized several important extension activities such as farmer's trainings, extension personnel training, nematode awareness day, Gehun Gyan Sutrakermi Jagriti Diwas and field days. The Purpose of these programme was to educate the farmers and field functionaries about the crop disease caused by nematodes particularly molya. In these programmes KVK scientists delivered expert lecture on nematode management in wheat & barley, the major nematode problem of our District. Extension literature also prepared and distributed by KVK experts on nematode problem and their management .The problem and its remedies were also highlighted continuously through print media (literature, t.v talk, radio talk , newspaper and SMS etc.)Technical back stopping were taken from Department of Nematology, CCS HAU, Hisar. An exhibition programme was also organized in which nematode symptoms and control measures were depicted.

In each of these programmes a buzz session was also organized in which quaries raised by the participating farmers' were answered by the KVK & HAU scientist of different discipline present on the occasion:-

Cereal cyst nematode (*Heterodera avenae*) in wheat and barley: Status of Molya disease of wheat and barley in district.

- Total blocks: 6 (Ratia, Jakhal, Tohana, Bhattu, Fatehabad, Bhuna)
- Molya disease infested blocks: 3 (Bhattu, Fatehabad some parts of Bhuna)
- Total villages in the District: 245
- Molya infested villages in the district: 49
- Molya infested area: Approx. 35000 ha
- Total sample collected till date: 300 (30 to 35 sample/ year)
- Molya infested sample : 223
- Molya % infestation : 66.90

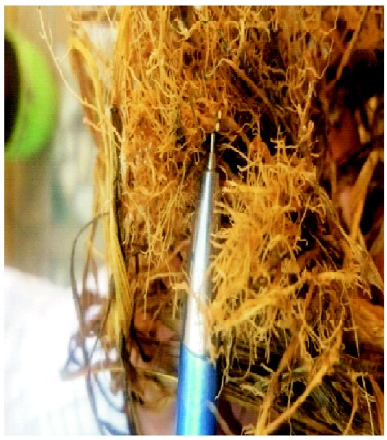


Survey

Three blocks of the district i.e. Fatehabad, Bhattu and some parts of Bhuna having sandy soils are prone to incidence of cereal cyst nematode in wheat and barley, which reduced the yield of wheat crop to half. Sometimes farmers' of these three blocks used to harvest 30-35 qt/ha yield of wheat in heavy nematode infested area. Farmers were not aware of

this hidden enemy i.e cyst nematode. Keeping in view the severity of the problem and losses caused by this nematode in large area, Krishi Vigyan Kendra Fatehabad made a comprehensive survey conducted every year in these three blocks and soil sample were collected. the soil sample were analyzed in Laboratory of nematology CCS HAU Hisar before the start of rabi season every year. KVK conducted awareness programme i.e Gehun Gyan avem Sutrakermi Jagriti Diwas in the nematode affected villages of the district. In each programme about hundred farmers of the affected area participated. In the district Fatehabad 8 sutrkrimi Jagriti diwas were organized till date. (Annexure I)

Molya nematode infested wheat field



Molya nematode infested wheat root

Nematode identification by microscope

Annexure - I

Sr. No.	*Name of extension activities*	*Date*	*Venue*	*Dignitaries present*	*Participants*	*Extension functionaries*	*Total*
1.	Gehun Gyan avem Sutrakermi Jagriti Diwas	09.11.09	Dharania	Dr. J.K. Abhir, SDM, Fatehabd	134	16	150
2.	Gehun Gyan avem Sutrakermi Jagriti Diwas	15.11.10	Sirdhan	Dr. J.K. Abhir, SDM, Fatehabad	100	10	110
3.	Gehun Gyan avem Sutrakermi Jagriti Diwas	09.11.11	Kumharia	Dr. R.S. Banga, AD(FAS), CCS HAU, Hisar	70	8	78
4.	Gehun Gyan avem Sutrakermi Jagriti Diwas	17.11.12	Khabra Kalan	Dr. Ravi Kumar, AD (Research Extension Linkage), CCS HAU, Hisar	129	11	140
5.	Gehun Gyan, Sutrakermi Jagriti avem Pardarshni Diwas	07.11.13	Dhabi Khurd	Dr. S.S. Siwach, Director of Research and Director of Extension, CCS HAU, Hisar	125	15	140
6.	Gehun Gyan, Sutrakermi Jagriti avem Pardarshni Diwas	04.11.14	Kirdhan	Dr. R.K. Walia, Associate Dean, and Prof. & Head, Deptt. of Nematology, CCS HAU, Hisar	100	11	111
7.	Gehun Gyan, Sutrakermi Jagriti avem Pardarshni Diwas	09.11.15	Bhirdana	Dr. R. S. Kan war, Senior wheat nematologist, CCSHAU, Hisar	45	5	50
8	Gehun Gyan, Sutrakermi Jagriti avem Pardarshni Diwas	04.11.16	Dhand	Dr. R. S. Kanwar, Senior wheat nematologist, CCSHAU, Hisar	66	4	70

Gehun Gyan, Sutrakermi Jagriti avem Pardarshni Diwas

09.11.2009

15.11.2010

09.11.2011

17.11.2012

07.11.2013

04.11.2014

09.11.2015

04.11.2016

In these programmes farmers' were convinced for crop rotation with mustard or to grow barley resistant variety i.e BH-393, BH-75, RD-2508, and RD-2035 to get rid of this serious cyst nematode. Farmers were also educated to adopt the resistant variety of wheat i.e. Raj MR-I and seed treatment with Biotika HT-54. With the seven years efforts made by the KVK scientists the farmers' had been successful in managing this nematode through crop rotation with mustard. As a result of this area under musturd has increased to 14300 ha. In 2016-17 The KVK also conducted FLD's on these practices and at the time of maturity of the crop field days were also organized on that FLD. Till now four Molya Field Days (Khet Diwas) were organized by KVK (Annexure II)

FLD 1

Management of Cereal Cyst Nematode (*Heterodera avenae*) in Wheat

(Variety - WH-711) Initial Nematode Population above ETL Level No. of Trials: 04 (Badopal, Dharania, Bighar)

S.No.	*Treatment*	*Yield(q/ha)*	*% yield increase*
1	T1= Seed treatment with HT -54 (Azo-tikka)	39.0	6.55
2.	T2= Seed treatment with HT-54 (Azo-tikka) + Carbofuran 3G@33kg/ha	45.0	22.95
3	T3= Carbofuran 3G@33 kg/ha	40.6	10.92
4	T4= FP	36.6	-

Date of Sowing = 2nd Week of Nov. 2009 Date of Harvesting = First fortnight of April, 2010

Results: The farmers' were fully convinced with T2 treatment followed by T3.

FLD 2

Management of Molya Nematode (*Heterodera avenae*) Wheat through different Practices

No. of Trials – 02 (Dharania, Salamkhera) **Plot Size – ½ Acre**

Sr. No.	*Treatment*	*INP(above ETL level cyst/Kg soil*	*FNP cyst/ per kg soil soil*	*Yield q/ ha*	*% reduction in cyst population*	*% increase in yield*
1	T_1 = Seed treatment with (Azo -tikka HT-54 + Application of carbofuran 3G @ 33 kg/ha at the time of sowing)	22	31	37	+40.90	60.86
2	T_2 = Di versification through mustard (RH-406)	22	15	25	- 31.81(Mustard crop gave better returns compared to wheat and decreased cyst population upto 31.81%	8.69
3	T_3 = Molya resistance RAJ MR-1	22	17	42	-22.72	82.60
4	T_4 = Control (FP)	22	40	23	--	--

Date of sowing : First week of Nov. 12 **Date of Harvesting : Second week of April, 13**

Results: The farmers' were fully convinced with T2 treatment crop rotation with mustard followed by T3 and T1 treatments.

Management of Molya Nematode (Heterodera avenae) in wheat by using different practices

FLD 3

Management of Molya Nematode (Heterodera avenae) in wheat by using different practices

Total Area - 2 Kanal of each treatment **No. of Farmers - 2**

Sr. No.	*Treatment*	*INP above ETL level cyst/ per kg soil*	*FNP cyst/ per kg soil soil*	*% reduction in cyst population*	*Yield qtl/ ha*	*% increase in yield*	*B:C Ratio*
1	T_1 = Control (FP)	12	25	+108.33	26	-	1.07
2	T_2 = Seed treatment with (Azo-tikka HT -54 + Application of carbofuran 3G @ 33 kg/ha at the time of sowing)	12	10	-16.66	32	23.07	1.28
3	T_3 = Diversification through mustard (RH-406)	12	6	-50	25	50 (Mustard crop gave better returns compared to wheat and decreased cyst population upto 50%)	-
4	T_4 = Molya resistance RAJ MR-1	12	8	-33.33	34	34.61	1.40

Date of sowing : First week of Nov. 13 **Date of Harvesting : Second week of April , 14**

Results: Economics of Sarson performed better than Wheat in Nematode Infested Area.

FLD 4

Management of Molya Nematode (Heterodera avenae) in wheat by using different practices

Total Area - 2 Kanal of each treatment **No. of Farmers - 5**

Sr. No.	*Treatment*	*INP above ETL level cyst/ per kg soil*	*FNP cyst/ per kg soil*	*% reduction in cyst population*	*Yield qtl/ ha*	*% increase in yield*	*B:C Ratio*
1	T_1 = Control (FP)	11	24	+111.8	25.30	-	1.28
2	T_2 = Seed treatment with (Azo-tikka HT - 54 + Application of carbofuran 3G @ 33 kg/ha at the time of sowing)	11	9	-18.18	29.60	16.9	1.34
3	T_3 = Diversification through mustard (RH-406)	11	5	-54.54	17.20	54.54 (Mustard crop gave better returns compared to wheat and decreased cyst population upto 54.54%)	Economics of sarson better than wheat in nematode infested area

Date of sowing : First week of Nov. 14 **Date of Harvesting : Second week of April, 15**

Results: Farmers are satisfied with crop rotation with mustard crop was better in nematode infested area.

Annexure II

Sr. No.	*Name of extension activities*	*Date*	*Venue*	*Dignitaries present*	*No. of participants*	*Extension functionaries*	*Total*
1.	Molya Khet avem Sutrakermi Jagriti Diwas	10.3.10	Khabra Kalan	Dr. H.D. Yadav, DEE, CCS HAU, Hisar	145	12	157
2.	Molya Khet avem Sutrakermi Jagriti Diwas	10.3.11	Khara Kheri	Dr. R.P. Narwal, Director of Research, CCS HAU, Hisar	100	14	114
3.	Molya Khet avem Sutrakermi Jagriti Diwas	22.03.12	Khara Kheri	Dr. S.S. Dahiya, Registrar, CCSHAU, Hisar	89	21	110
4.	Molya Field Day on Wheat	20.03.13	Salamkhera	Dr. S.K. Sharma, AD(FAS), CCSHAU, Hisar	91	10	101

10.03.2010

11.03.2011

22.03.2012

20.03.2013

In these field days farmers and dignitaries were shown molya symptoms and white females present on roots and scientist also elaborated management technologies generated by CCS HAU, Hisar and adopted by the farmers. Adoption of management practices by the farmers increased. Where the farmers were facing acute nematode problem in wheat and barley. In the year 2008-09 area under mustard crop was 8730 ha whereas in the year 2016-17 it increased upto 14300 ha.

Table 1

Year	*Area (000ha)*	*Increases area under mustard (ha.)*	*Productivity q. Per hec.*	*Production Lac. q.*	*Productivity q. Per ha.*	*MSP of Wheat*	*Saved money in Lac. (*Loss of wheat due to molya if farmer grow wheat in that area)*
	Mustard				Wheat		
2008-09	8730	-	17.38	14.54	-	-	-
2009-10	9000	270	19.08	17.17	46.14	1080	26.90
2010-11	10000	1000	21.26	21.26	45.26	1100	99.57
2011-12	9000	-	18.66	16.79	50.81	1170	-
2012-13	12000	3000	15.99	19.18	54.72	1285	443.23
2013-14	12400	400	18.53	22.97	46.81	1350	-
2014-15	12450	50	15.37	19.13	53.18	1400	7.44
2015-16	14000	1550	13.55	18.97	48.58	1450	218.37
2016-17	14300	300	-	-	-	-	55
Total							**850.51**

Source: DDA, Fatehabad

* Loss consider 20 % of molya nematode in wheat based on conducted surveys and percent reduction yield in FLD trials conducted by KVK.

Saved money formula = area increased under mustard crop (if farmer grow wheat in that are) x wheat productivity x 20% yield loss x wheat MSP

For example (2009-10) = **270x46.14=$\frac{12457.80x20}{100}$ = 2491.56 x 1080 = 26.90 Lac.**

CONCLUSION

Fatehabad district was facing the problem of molya nematode due to sandy nature of soil. The soil type of three blocks of the district is sandy and area covered 103964 ha. Molya nematode are very serious problem in sandy soils. After 2009 a comprehensive study was made by KVK scientist in colabration with department of Nematology CCS HAU Hisar. Every year 30-35 samples were collected from these three blocks of the district. The sample were visually observed and analysed in the nematology laboratory. After observation we selected the problematic villages where cyst population was more than 10 cyst per kg soil (above ETL).

The KVK Scientist organized different types of awareness programmes before the onset of rabi season. The front line demonstration on management practices of cyst nematode were conducted in these villages. At the time of the majority field day were conducted to motivate and educate the farmer, as well as extension functionaries department of Agriculture and Horticulture. By conducted these extension activities the farmer of the district started adopting crop rotation with mustard instead of monoculture of wheat in problamatic fields. As a result of this area under mustard increased from 8730 ha. In 2008-09 to 14300 in 2016-17. and molya incidence was reduced year by year. This could be possible due to the extension activities (print media, radio tv talk, extension literature and advisory services) conducted by KVK fatehabad and deptt. of Nematology CCS HAU Hisar. In monitory terms, the farmer of the district saved **Rs. 8.51 Cr**. During 2009-10 to 2016-17 by adopting the crop rotation with mustard. Beside these earlier farmer use under dose of carbafuran 3G at wrong time. In the extension activities KVK advised and impressed upon the farmer to use proper dose (13 kg per acre) at proper time (at the sowing time) due to these efforts average productivity of wheat of the district is increased as compare to other district where this nematode problem is occur. Farmer also started sowing of molya resistant variety such as RAJ.MR-1 in problematic field. In case of barley the farmer also started growing of molya resistant variety BH-393 and BH-75.

All this helped in reducing the disease intensity as indicated by latest survey in feb-2017 in the district and improved economic status of farmers.