

# MANGO DISEASES DIAGNOSIS COMPETENCY OF FARMERS USING COLOUR DISEASES IMAGES

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## ABSTRACT

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Competency of mango growers in diagnosis of mango diseases using coloured images were studied on randomly selected 60 respondents of Panishara union at Jhikorgacha upazila under Jashore district of Bangladesh through personal interview during October to November, 2019. Coloured images of nine diseases i.e. anthracnose, stem end rot, sooty mold, black tip, powdery mildew, mango malformation, die back, scab and red rust were considered for interviewing the mango growers. Considering all nine mango diseases most (85%) of the respondents possessed medium level of competency in diagnosis of mango diseases while 11.7% of them had high level and 3.3% of them showed low level of competency. The respondents showed highest level of competency

in diagnosis of anthracnose disease (93.33%) followed by sooty mold (93%), powdery mildew (89.16%) while they showed least competency in diagnosis of red rust disease (6.94%) and black end disease (18.33%). Among eleven selected characteristics of mango growers' age, farming experience, cosmopolitaness, extension media contact and training received related to agriculture showed significant positive relationship while area (orchard size) under mango orchard showed negative relationship with their mango disease diagnosis competency. The mango growers of the study area were competent enough in diagnosing mango diseases using coloured images in general.

Key words: Mango, disease, diagnosis, competency, farmers, colour image

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## INTRODUCTION

Agriculture is the dominant economic activity in Bangladesh and regarded as the lifeline of the nation's economy and contributes about 12.68% to the country's GDP as in July 2020 (www.statista.com). Fruit contributes 10% in income of the national economy and covered 1-2% of the total cultivable land in Bangladesh (Mondal *et al.* 2011) where mango ranks second position in terms of area cultivated and first in terms of production. The country produced about 12,88,315 metric tons of mangoes annually from 1,02,939 acres of land (BBS 2017, Sampa *et al.* 2019). Bangladesh is one of the major mango producing countries and it ranks 8th among the top mango producing countries in the world (Islam 2011). The demand of fruit especially mango is increasing day by day with growing population where decline in production results in scarcity every year. Various factors are responsible for lowering the yield of mango worldwide where diseases play a major role and the production could be increased at least by 28%, if the crop could be protected from various diseases (Islam *et al.* 2015). Disease is a major cause of lowering

mango production in Bangladesh (Meah and Khan 1987).

Seedling of mango is frequently affected by physical and physiological disorders as well as diseased caused by fungi, bacteria and viruses. Meah and Khan (1987) reported as many as 18 different diseases of mango all over Bangladesh. Anthracnose, stem end rot, powdery mildew, sooty mould, malformation and fruit rot complex were very common and destructive disease in Bangladesh. Out of these diseases Anthracnose, die back, powdery mildew, leaf spot, sooty mould and red rust are important caused by *Colletotrichum gloeosporioides*, *Oidium mangifera*, *Alternaria alternata* and *Cephaleuros virescens*, respectively are the predominant (Hossain 2017). It is most essential to identify the diseases of mango for adoption of a successful control measure. Some common diseases such as anthracnose, sooty mold, die back have distinct and identifiable symptoms and can be diagnosed accurately in the field by unaided eye, there are many diseases having similar non-specific symptoms (Burgess *et al.* 2008).

As all the diseases are not prevailed on the mango plants throughout the year that is why coloured images were used to determine the mango disease diagnosis competency of the farmers. Considering these facts in view the study was conducted to analyze the characteristics of mango growers, for determining the mango disease diagnosis competency of the farmers using colour diseases images and also to explore relationships between selected characteristics of the mango growers and their disease diagnosis competency.

## MATERIALS AND METHODS

**Locale and design of the study:** The study was conducted at six selected villages namely Panishara, Narangali, Krishnachandrapur, Kulia, Shiordha and Kanailari of Panishara union under Jhikorgaccha Upazila in Jashore district of Bangladesh following diagnostic and descriptive research design. Descriptive research design was a theory-based design, where the researcher was primarily interested in describing the topic that was the subject of the research. It was applied to case studies, naturalistic observation, surveys and so on. This method included data collection, analysis, and presentation. It let the researcher clearly present the problem statement in order to allow others to better understand the need for targeted research. It could help finding out more factors that lead to specific issues or challenges the farmers might be facing. This design usually consisted of three research phases, (1) problem inception, (2) problem diagnosis, and (3) problem solution, which in combination called diagnostic and descriptive research design (Kothari 2004).

**Population and sampling:** The rural people of the study area who were involved in mango cultivation were treated as population of this study. Irrespective of size of population of mango growers in the selected six villages, 60 mango growers were randomly selected and each farmer was considered as a sample.

**Data collection:** The data were collected from the study area through personal interview individually by using an interview schedule during October to November, 2019.

**Measurement of selected characteristics:** A good number of characteristics were existed among the respondents i.e. mango growers those sharply varied from one another. Only eleven (11) characteristics

were selected and their measuring units were briefly mentioned in table 1.

Table 1. Measurement of the selected characteristics of mango growers

Sl. No.	Characteristics of respondents	Measuring units
1	Age	Year
2	Educational qualification	Year of schooling
3	Mango farming experience	Year
4	Family size	Number of family members
5	Family members involved in agriculture	Number
6	Farm size	Hectare
7	Area under mango orchard	Hectare
8	Family income (annual)	BDT
9	Cosmopolitaness	Score
10	Extension media contact	Score
11	Training received related to agriculture	Score

**Measurement of mango disease diagnosis competency:** Disease diagnosis competency refers to the capacity of diagnosing a disease. To determine the disease diagnosis competency of the mango growers using colour disease image, three aspects such as disease name, symptoms and control measure were considered. Anthracnose, stem end rot, sooty mold, black tip, powdery mildew, mango malformation, die back, scab and red rust diseases were considered for interviewing the mango growers. The coloured images showing typical symptom of each disease of mango was printed in separate sheet without the title of disease. The colour images of those nine mango diseases were supplied to each of the farmers or respondents (Fig. 1-7) and mango growers were asked to identify the name of disease by observing the colour image as well as to mention the symptoms and control measures of the identified disease. Equal score of 1 was assigned against each of the aspects i.e. name, symptom and control measures of the disease. Therefore, the total score of each disease was 3. A total number of 9 diseases were included in the interview schedule. Thus the disease diagnosis competency scores among the respondent could range from 0-27. The obtained score of a respondent was determined based on the accuracy of answer. The respondents were classified into three groups (low, medium and high) based on disease diagnosis competency scores

obtained by them as indicated in table 2 following equal interval principle of classification (Ahmed *et al.* 2007).

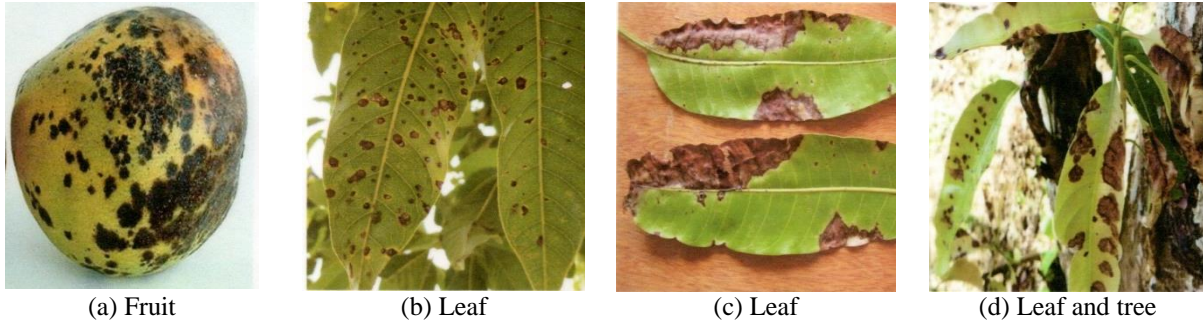


Figure 1. Colour images of anthracnose disease of mango leaf and fruit used in the farmer's interview

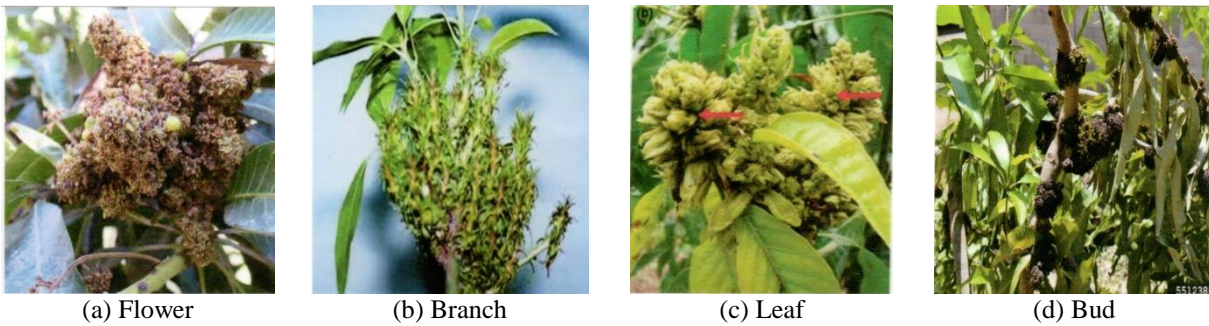


Figure 2. Colour images of malformation disease of mango used in the farmer's interview

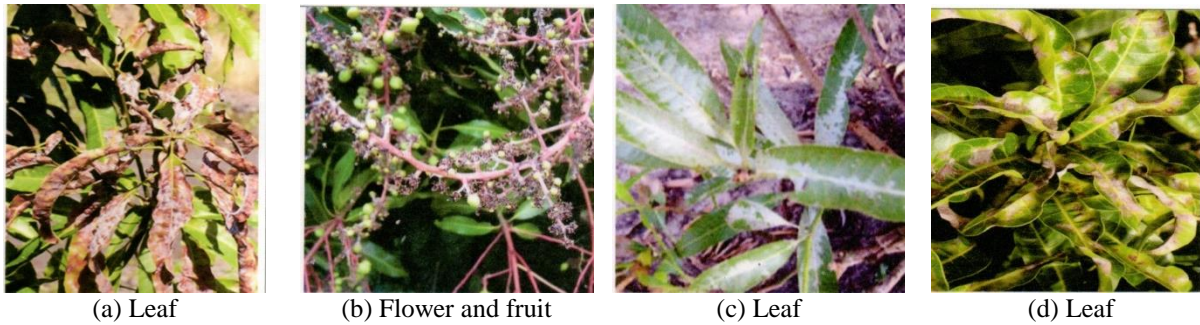


Figure 3. Colour images of powdery mildew disease on leaf, flower and fruit of mango

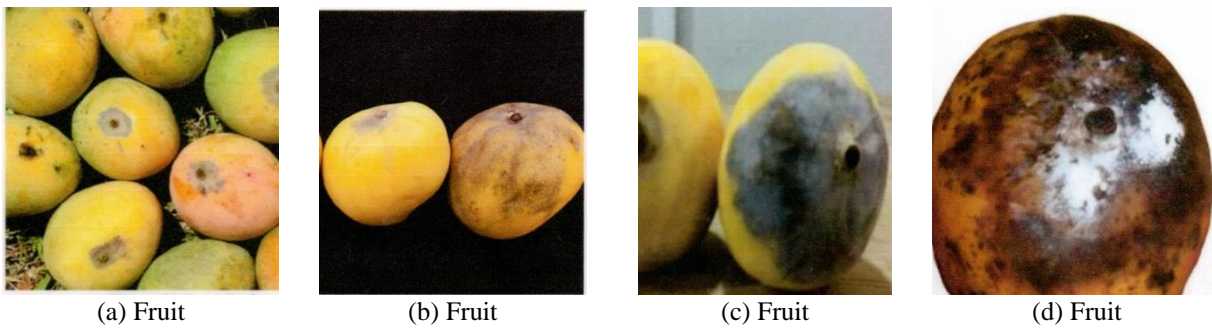


Figure 4. Colour images of stem end rot disease of mango fruit used in the farmer's interview



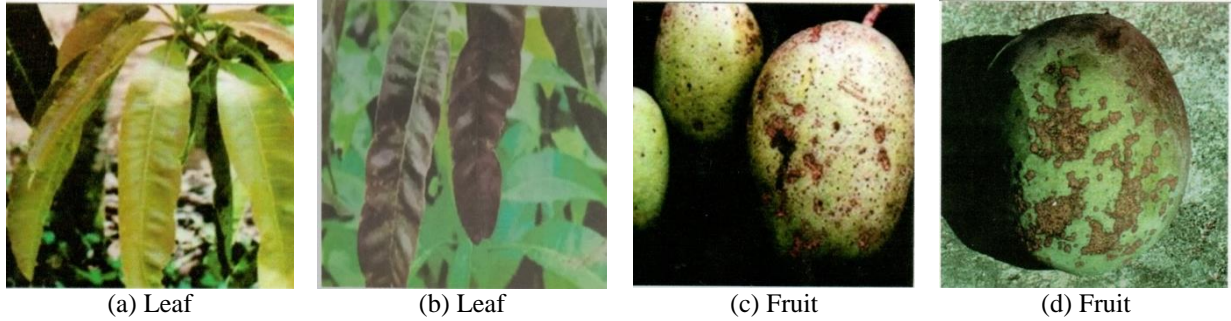


Figure 5. Colour images of scab disease of mango leaf and fruit used in the farmer's interview



Figure 6. Colour images of die-back disease of mango used in the farmer's interview

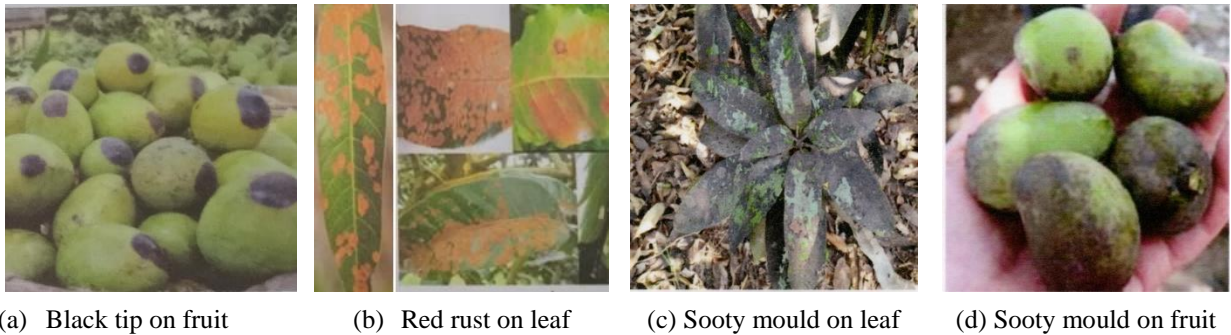


Figure 7. Colour images of black tip, red rust and sooty mould diseases of mango used in interview

Finally those nine diseases were ranked based on Disease Diagnosis Index (DDI). The DDI was calculated by using the following formula.

$$DDI = \frac{\text{Total obtained scores by 60 respondents}}{\text{Possible total score by 60 respondents}} \times 100$$

As the weightage of a disease was 3, the total possible score could be 180 by 60 respondents against a particular disease. The obtained scores could range from 0-180 where "0" indicated no competency where "180" indicated highest level of competency of the respondents to diagnosis particular disease. For example, if the total obtained score of 60 respondents on anthracnose disease was 168 against possible score of 180 then the calculated DDI would be 93.33% ( $DDI = \frac{168}{180} \times 100 = 93.33$ )

The DDI was calculated for each of the nine diseases individually. Based on DDI value, the nine mango diseases were ranked for identifying the disease diagnosis competency of the farmers against a particular disease.

Table 2. Categories of the respondents according to their mango disease diagnosis competency

Categories of respondents (mango growers)	Total score obtained
Low Competency	≥9
Medium Competency	10-18
High Competency	>18

## RESULTS AND DISCUSSION

### Selected Characteristics of the Mango Growers

The number of mango growers was almost similar in three different age groups where the highest proportion (35%) of the respondents was young aged category compared to old aged (33.3%) and middle aged (31.7%). Most of the respondents were literate (88.3%) i.e. primary to above higher secondary level of education, whereas 11.5% of the respondents had no institutional education (Table 3). Similar results were found by other authors indicating that about one fourth (26.70%) of the respondents had secondary level of education (Alam *et al.* 2017, Mondol *et al.* 2019). Mondol *et al.* (2019) found that few portion (13.20%) of the respondents had higher secondary level of education. Majority of the respondents were medium experienced (71.7%) in mango farming followed by high experienced (18.3%) and low experienced (10.0%) (Table 3). Alam *et al.* (2017) found that about one fifth (21.9%) of the respondents had high mango farming experience. Mondol *et al.* (2019) found that few portion (18.9%) of the respondents had high farming experience. Majority of the respondents had small sized family (55%) while 38.3% and 6.7% belonged to medium size and large size family respectively.

The average family size (4.416) of the study area indicated that the respondents were not conscious about their family size and population growth and the average family size of the study area was higher than that of national size average 4.06 (HIES 2016). Above three fourth (76.7%) family members of the respondents had low involvement in agriculture followed by medium involvement (18.3%) and high involvement (5%). Majority (58.3%) of the respondents had small farm size. The findings were almost in agreement with other authors (Alam *et al.* 2017, Das *et al.* 2019, Mondol *et al.* 2019). The average farm size of the respondents of the study area (1.11ha) was higher than that of the national average (0.60 ha) of Bangladesh (BBS 2014). Most (81.7%) of the respondents had small sized mango orchard followed by medium (13.3%) and large (5%). Alam *et al.* (2017) found that least proportion (6.70%) of the respondents had large sized of land under mango orchard. It revealed that the respondents of the study area were not much adaptive for mango production. Half (50%) of the respondents belonged to medium annual income group as compared to high (33.3%) and low (16.7%) income group. The results were almost similar to the findings of other authors (Alam *et al.*

2017, Islam 2002, Mondol *et al.* 2019). Most (96.7%) of the respondents had medium cosmopolitaness.

Majority (61.7%) of the respondents had low extension media contact. Most of the respondents were either not getting help from the extension workers or not aware of the services provided by different extension agencies. Majority (70%) of the respondents did not receive any training related agricultural activities. Mondol *et al.* (2019) reported that least proportion (1.7%) of the respondents received higher training, while majority (71.70%) of the respondents did not receive any training related agricultural activities followed by low (24.50%) and medium (3.80%). None of the respondents belonged to higher training category (Table 3). **Disease**

### Diagnosis Competency

The computed disease diagnosis competency scores of the respondents ranged from 8 to 19 with the mean and standard deviation of 15.18 and 2.31, respectively. On the basis of disease diagnosis competency scores, the respondents were classified into three categories namely low ( $\leq 9$ ), medium (10-18) and high ( $> 18$ ). The distribution of the respondents according to their disease diagnosis competency was varied sharply (Table 4). Most of the respondents (85%) showed medium level of competency in diagnosis of the nine selected diseases of mango while above one-tenth (11.7%) of them showed high level of competency and a very few (3.3%) of the respondents showed low level of competency (Table 4).

### Disease Diagnosis Competency Index

Competency in mango disease diagnosis varied sharply among the growers (Table 5). Out of selected nine mango diseases, the respondents showed highest level of competency in diagnosis of anthracnose disease (93.33%) followed by sooty mold (93%), powdery mildew (89.16%), die back (81.94%), mango malformation (52.77%) and stem end rot (50.55%). On the other hand, the respondents showed least competency in diagnosis of red rust disease (6.94%) followed by black end (18.33%) and scab (20.83%). Anthracnose, sooty mold and powdery mildew were the most common diseases of mango in the study area. Almost all farmers faced these diseases at several times and they were very much familiar and could easily diagnose these diseases.

Table 3. Facts on the selected characteristics of the respondents (mango growers)

Characteristics	Category	Respondents(N=60)		Range	Mean	SD
		Number	%			
Age (year)	Young (up to 35)	21	35.0	23-70	45.26	12.77
	Middle (36-50)	19	31.7			
	Old (above 50)	20	33.3			
Educational Qualification (year of schooling)	Illiterate (0)	7	11.7	0-18	9.51	5.07
	Primary (1-5)	7	11.7			
	Junior School Certificate (6-8)	8	13.3			
	Secondary (9-10)	15	25.0			
	Higher Secondary (11-12)	8	13.3			
	Above Higher secondary (above 13)	15	25.0			
Mango farming experience (year)	Low (<3)	6	10.0	2-25	10.41	7.40
	Medium (3-18)	43	71.7			
	High (>18)	11	18.3			
Family size (year)	Small (up to 4)	33	55	1-10	4.41	1.48
	Medium (5-6)	23	38.3			
	Large (above 6)	4	6.7			
Family members involved in agriculture	Low (up to 1)	46	76.7	1-3	1.28	0.52
	Medium (2)	11	18.3			
	High (above 3)	3	5.0			
Farm size (hectare)	Landless (<0.02)	0	0	0.17-2.73	1.11	1.09
	Marginal farmer (0.02-0.2)	3	5.0			
	Small farmer (0.21-1.0)	35	58.3			
	Medium farmer (1-3)	18	30.0			
	Large farmer (above 3)	4	6.7			
Area under mango orchard (hectare)	Small area (<0.45)	49	81.7	0.03-1.33	0.24	0.28
	Medium area (0.45-0.90)	8	13.3			
	Large area (>0.90)	3	5.0			
Family income ("000"BD)	Low (up to 100)	10	16.7	100-800	248.91	175.63
	Medium (101-200)	30	50.0			
	High (above 200)	20	33.3			
Cosmopolitaness (score)	No (0)	00	00	6-18	13.76	2.25
	Low (1-9)	2	3.3			
	Medium (10-18)	58	96.7			
	High (above 18)	00	00			
Extension media contact (score)	No (0)	00	00	5-22	12.71	3.76
	Low (1-13)	37	61.7			
	Medium (14-26)	23	38.3			
	High (up to 26)	00	00			
Training received related to agriculture (score)	No (0)	42	70.0	0-5	0.46	0.87
	Low (1)	14	23.3			
	Medium (2-3)	3	5.0			
	High (above 3)	1	1.7			

Table 4. Distribution of the respondents according to their disease diagnosis competency

Categories	Score	Respondents (N=60)		Range	Mean	SD
		Number	Percentage			
Low Competency	≤9	2	3.3	8.00-19.0	15.18	2.31
Medium Competency	10-18	51	85.0			
High Competency	>18	7	11.7			
Total Competency		60	100.0			

SD = Standard Deviation

Table 5. Disease Diagnosis Competency Index (DDI)

Name of the diseases	Disease Diagnosis Competency Index (DDI)		Rank
	Score	Percent	
Anthracnose	168	93.33%	1 <sup>st</sup>
Stem end rot	91	50.55%	6 <sup>th</sup>
Sooty mold	167.5	93%	2 <sup>nd</sup>
Black tip	33	18.33%	8 <sup>th</sup>
Powdery mildew	160.5	89.16%	3 <sup>rd</sup>
Mango malformation	95	52.77%	5 <sup>th</sup>
Die back	147.5	81.94%	4 <sup>th</sup>
Scab	37.5	20.83%	7 <sup>th</sup>
Red rust	12.5	6.94%	9 <sup>th</sup>

Table 6. Relationship between the selected characteristics of the respondents with their mango disease diagnosis competency

Independent variables	Dependent variable	Correlation coefficient(r)
Age	Disease Diagnosis Competency	0.297*
Educational qualification		0.015NS
Mango Farming experience		0.340**
Family size		-0.045NS
Family member involved in agriculture		-0.037NS
Farm size		-0.056NS
Area under mango orchard		-0.299*
Annual income		-0.125NS
Cosmopolitaness		0.442**
Extension media contact		0.334**
Training received related to agriculture		0.419**

\* = Significant at the rate of 5%,

\*\*= Significant at the rate of 1% and

NS= Non-Significant

### Relations between characteristics of respondents with disease diagnosis competency

Correlation analysis indicated that among 11 selected characteristics mango growers viz. age, farming experience, cosmopolitaness, extension media contact and training received related to agriculture showed a positive significant relationship while area under mango orchard showed a negative significant relationship with their mango disease diagnosis competency (Table 6). The higher was the age, farming experience, cosmopolitaness, extension media contact, training received related to agriculture of the mango growers, the higher was their mango disease diagnosis competency. On the other hand, the higher was the area under mango orchard of the respondents the lower was their mango disease diagnosis competency. The negative significant relationship might be due to passive involvement of the owners of the mango orchard in mango production. The owners of the mango orchard often lease their land to others who were quite unable to diagnose such diseases of mango.

### CONCLUSION

Most of the mango growers in the study area possessed medium to high level of competency in diagnosis of mango diseases and had highest level of competency in diagnosis of anthracnose disease followed by sooty mold, powdery mildew and die-back and also able to take appropriate control measure against the common diseases.

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