

DEGREE OF RESISTANCE TO ANTHRACNOSE IN FIVE WATERMELON VARIETIES  
AND  
INHERITANCE OF RESISTANCE TO THE FUNGUS  
COLLETOTRICHUM LAGENARIUM (PASS.) ELL. AND HALS.

by

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## INTRODUCTION

Anthracnose caused by the fungus Colletotrichum lagenarium (Pass.) Ell. & Huls. has been recognized as the most destructive disease of watermelon in almost all melon growing regions of the United States, with the possible exception of California. Heavy losses have resulted in Kansas due to this disease. During some years the disease builds up early in the season and in others the greatest injury is done in late season. In the field, anthracnose causes defoliation of plants, fruit rot and the infected melons may rot in transit.

The fungus can attack all above ground parts of the watermelon plant in all stages of development. The leaves show irregular black spots which enlarge until the whole leaf is involved. In severe cases the melon field may look as if 'burned over', Plate I. Lesions on petioles and stems appear as small water soaked areas which may later coalesce. Spore masses are also found in the lesions. On fruits the fungus may cause small water soaked spots which enlarge and by coalescence spread over a large part of the fruit surface, Plate II.

Development of resistant varieties is the ideal method of disease control and is of utmost importance in all watermelon breeding programs at the present time. Incidentally, Fusarium wilt of watermelon was one of the diseases Orton (8) combated successfully through breeding of a resistant variety. This classical work of Orton opened a vista of hope for the control of other diseases by this method.

#### EXPLANATION OF PLATE I

Anthracnose in a Kansas watermelon field with Charleston Gray, a resistant variety, on the left and Black Diamond, a susceptible variety on the right.

## PLATE I



EXPLANATION OF PLATE II

Black Diamond watermelon fruits  
showing anthracnose lesions.

## PLATE II



As for the control of watermelon anthracnose, the report of Layton and Wilson (6) in 1930 on the difference of resistance in the three watermelon varieties, Iowa Belle, Iowa King and Pride of Muscatine, laid a corner stone for exploring a possibility of breeding watermelon for resistance to anthracnose. A suggestion of Porter and Melhus (11) in 1932 to use Kafir and White seeded citron because of some resistance in them, lent further support to that possibility. However, it was left to Layton (5) to initiate an extensive investigation on different aspects of the disease. He published his findings in 1937 covering host range of the fungus, technique of inoculation, measurement of relative resistance and mode of inheritance of resistance. Many wilt and anthracnose resistant strains have been developed from crosses that Layton made with anthracnose resistant, but wilt susceptible African watermelons.

Ten years later Dolan (3) reported that he did not obtain the same type of inheritance of anthracnose resistance with the variety McCrea as was reported by Layton with the African watermelons.

Since that time, the breeding of anthracnose resistant varieties with other desirable horticultural characteristics has been under way at many places, some of which include Iowa, Florida and U.S.D.A. Vegetable Breeding Laboratory, Charleston. No published information is presently available resulting from a systematic study of the mode of inheritance of anthracnose resistance. Usefulness of such information in a breeding program can hardly be overemphasized.

Therefore, the present studies were initiated at Kansas State College in order to:

1. Screen some of the newer watermelon varieties for resistance to anthracnose,
2. Study the mode of inheritance of resistance to anthracnose, and
3. Utilize the information in watermelon breeding program at Kansas State College.

#### REVIEW OF LITERATURE

Literature on anthracnose of Cucurbits, which was first reported by Passerini in 1867 in Italy, was reviewed by Layton in 1937. It has been considered necessary to discuss in this review only those papers that have been published after Layton's review.

Orton's (8) remarkable success in producing the wilt resistant watermelon variety, Conqueror, by hybridization in the first quarter of the present century ushered in a new era in the field of crop production in the United States. His finding stimulated plant breeders and pathologists, in particular, to fight the menace of plant diseases through development of resistant varieties.

Layton and Wilson (6) provided clues to such a possibility in case of watermelon anthracnose, when they reported that Iowa Belle showed less anthracnose injury in greenhouse trials and in the field than either Pride of Muscatine or Iowa King, when ex-

posed to infection.

Porter and Melhus (11) gave further support to this view by suggesting the use of Kafir and White seeded citron as sources of resistance in the breeding of anthracnose resistant watermelon varieties.

Layton (5) made an extensive study of the disease. He brought into the picture such aspects as technique of inoculation, measuring of relative resistance to Colletotrichum lagenarium and description of symptoms of anthracnose for the more common hosts and newer hosts. He studied the effect of temperature on infection. He also included new hosts to the host range of the fungus. He observed that genus Cucurbita might be regarded as the most resistant genus, while Cucumis and Citrullus the most susceptible. In no commercial variety of watermelon, muskmelon or cucumber could he observe resistance sufficient to be of significance. Layton further studied mode of inheritance of resistance to anthracnose in watermelon. Crosses of the three edible African watermelon varieties, 8, 9 and 13 which were found to be highly resistant to anthracnose, but susceptible to fusarium wilt, were made with Iowa Belle, Iowa King and a few other miscellaneous watermelon varieties. He found that resistance to anthracnose was dominant over susceptibility and segregation in  $F_2$  and  $F_1$  back cross generations proved that only a single factor pair for resistance and susceptibility was involved.

Dolan (3) described a new anthracnose on melons caused by Marssonina melonis. He observed that Honey Cream watermelon was

much more resistant than other watermelons tested. However, the McCrea variety of watermelon was found to be susceptible to the new fungus. His tests for resistance to Colletotrichum lagenarium showed that plants of McCrea were the more resistant of those tested; but back cross progenies and  $F_2$  progenies of McCrea produced plants having medium to severe infection with Colletotrichum lagenarium and the results could not be fitted to any genetic ratio.

Boothroyd (2) later stated that disease described by Dolan was not an anthracnose and that the fungus should not be called Marssonina. He tentatively called the conidial stage a Cephalosporium. He observed the ascigerous stage of the fungus which resembled Venturia cucumerina Lfs. described on cucumber in Sweden in 1919.

Development of disease resistant watermelon varieites has greatly contributed to the knowledge of genetics of watermelon. Soon it was realized that resistance to disease was not the sole criterion for the success of a particular variety. It must also possess high horticultural qualities and be desirable in type.

Parris (9) gave a comprehensive account of the work of Porter and others in regard to inheritance of fruit characters and plant characters apart from the historical review of watermelon breeding for disease resistance.

Reviewing disease resistance in vegetable crops Walker (12) mentioned Congo and Black Kleckly as two watermelon varieties highly resistant to anthracnose. He went on to repeat that resistance to anthracnose was controlled by a single dominant

gene.

Andrus (1) described outlines of breeding program for disease resistance so as to keep in mind other characteristics of the plant for its successful cultivation. He emphasized the need for naming a variety rather than giving the collection number. He suggested a method for rating resistance and placed emphasis on desirability of thoroughness in tests against many pathogens. He also mentioned some of the limitations of disease resistance. He listed examples of resistance available in advanced horticultural crops.

Munger and Newhall (7) reviewing the history of breeding watermelon for resistance primarily dealt with fusarium wilt and anthracnose. They listed Congo as an anthracnose resistant variety possessing good horticultural characteristics. Realizing the fact that resistant varieties often prove unsatisfactory because of deficiencies in horticultural characteristics, they suggested back crossing to a variety of proven commercial value until the genotype of the commercial variety could be recovered in combination with resistance as an ideal breeding procedure. They considered it worthwhile to spend considerable time, at the beginning of a breeding program, in search for immunity among foreign plant introductions rather than starting with high level of resistance and where inheritance is polygenic. Alternately they suggested to synthesize resistance by recombining genes from different varieties with partial resistance.

Goode (4) reported that the anthracnose resistant watermelon varieties, Charleston Gray, Congo and Fairfax were susceptible

at four locations in East North Carolina to fungus which was indistinguishable culturally and morphologically from Colletotrichum lagenarium (Pass.) Ell. & Hals. An additional isolate from the U.S.D.A. laboratory at Charleston, S.C., also proved pathogenic to these varieties. The results therefore, suggest that there are two or more physiologic races of Colletotrichum lagenarium.

#### MATERIAL AND METHODS

This study was initiated at Kansas State College in March and continued until October 1956. In all the three experiments Madison 11 was used as the standard strain of the fungus Colletotrichum lagenarium (Pass.) Ell. & Hals., causing melon anthracnose. In the second experiment, a Georgia strain of the fungus was compared with the standard. In the first two experiments the five watermelon varieties, Black Diamond, Congo, Charleston Gray, Chris Cross and Fairfax were tested for relative resistance to the fungus. During the summer of 1956 all the five varieties were grown at the Ashland Horticultural Farm where crosses were made between Black Diamond and the other four varieties. In the third experiment, these  $F_1$  hybrids were tested along with Black Diamond which is susceptible and Congo which is a resistant variety.

Seedlings of all the varieties and the crosses were grown and inoculated in the Horticultural Greenhouse. Cultures of the fungus were produced in the Botany mycological laboratory.

## Preparation of Culture

Source of Material. Six strains of the causal organism of anthracnose were obtained from different sources. Three strains labeled as Madison 1, 11, and 111 were received from Dr. Walker of the University of Wisconsin. One strain was received from Arkansas and one from Georgia. Later, another strain of the fungus was isolated from a watermelon grown in Johnson county, Kansas and was labeled as the Kansas strain.

All strains of the fungus were tested separately for their virulence on Black Diamond, a susceptible variety and on Congo, a resistant variety. For the sake of uniformity, the Madison 11 strain was used as a standard throughout the series of studies. This strain had proven most satisfactory in the preliminary test of virulence. The other two Madison strains were milder in action. The Arkansas strain failed to sporulate.

In the second experiment the Georgia strain of the fungus was compared to the standard strain on all five varieties. The Kansas strain was tested on Black Diamond and Congo in the third experiment.

Place Where Grown and Culture Medium. The fungus strains were maintained on potato-dextrose-agar in the Botany mycological laboratory. The strains were cultured on frozen snap bean sections in sterile test tubes. About 60 tubes were required to produce sufficient spores for a single treatment. The test tube cultures were incubated at 70 to 75° F. The spore covered bean

sections were placed in a small volume of distilled water and ground for about 15 to 20 minutes in a Waring blender. The mixture was then strained through cheese cloth to remove all coarse bean pod particles; and then diluted to make 500 ml. of stock spore suspension for the five replications. One hundred ml. of the stock suspension was further diluted to make one liter of spore suspension having spore concentration of approximately 50,000 spores per ml., for each replication of plants. The seedlings of each replication were inoculated with separately diluted spore suspension.

#### Technique of Inoculation

Seedlings were inoculated with the spore suspension by the "dunking technique" which was described by C.F. Andrus.<sup>1</sup> The technique is simple and proved to be very satisfactory. Pots bearing the seedlings were inverted and the seedlings dipped in the suspension, which was contained in a glass or enameled container, Plate III. Check plants were similarly dipped in tap water in order to maintain uniformity of treatment.

#### Description of Varieties

Seeds of the five varieties whose description is given in

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<sup>1</sup>Personal letter from W. M. Epps, Plant Pathologist, Charleston South Carolina, describing Andrus's technique of inoculation with certain modifications.

EXPLANATION OF PLATE III

The writer inoculating plants with a  
spore suspension of the fungus by the  
dunking technique.

## PLATE III



the following table were received from Wilhite Melon Seed Farms, Poolville, Texas. They were treated with Arasan. Seeds of the hybrids produced at the Ashland Horticultural Farm were disinfested by dipping them in 1:1000 solution of mercuric chloride for about ten minutes before planting.

### Greenhouse Technique

Soil Preparation: Field soil from the Ashland Horticultural Farm was used to grow seedlings. Two-inch clay pots were filled with the soil and steam-sterilized three to four days in advance of the planting. Sterilized soil was soaked well with water soon after sterilization and brought to optimum moisture condition before seeding.

Design of Experiments: Forty pots were seeded with four to five seeds per pot of each variety. Five replication, each of which consisted of eight pots per variety were used, making a total of about 150 seedlings per variety. In addition a complete replication of each variety was seeded simultaneously and kept separately to serve as a check in each experiment.

The pots were arranged with a randomized block design except in experiment two, where a randomized block split-plot design was used. In order to determine the virulence of different strains of the fungus, an additional 15 to 20 pots each of Black Diamond and Congo were seeded and inoculated with different strains of the pathogen.

## Description of Varieties

Table 1. Name, description and source of the varieties used in the experiments.

Name	Description	Released by
Black Diamond	The leading commercial watermelon variety grown in this region. Rind color: dark green Shape: large round Disease resistance claimed: none	Unknown
Charleston Gray	Rind color: gray Shape: cylinder Parentage: (Africa 8 x Iowa Belle) x Garrison) x Garrison) x (Hawkesbury x Leesburg) x Garrison) Disease resistance claimed: anthracnose and Fusarium wilt.	U.S.D.A. in 1954
Congo	Rind color: medium green with dark green stripes. Shape: cylinder Parentage: (African x Iowa Belle) x Garrison. Disease resistance claimed: anthracnose.	U.S.D.A. in 1949
Fairfax	Rind color: Light green with dark green stripes. Shape: cylinder Parentage: (Garrison x (African x Iowa Belle) x Leesburg x Hawkesbury)	U.S.D.A. in 1952
Chris Cross	Dixie Queen type Parentage: unknown Disease resistance claimed: wilt and anthracnose.	Originated by Chris Christensen of Montrose, Iowa in 1955.
Crosses made in summer 1956 at the Ashland Horticulture Farm:		
Black Diamond x Congo	F <sub>1</sub> seed from Black Diamond fruit	
Black Diamond x Charleston Gray	as above	
Black Diamond x Chris Cross	as above	
Fairfax x Black Diamond	F <sub>1</sub> seed from Fairfax fruit.	

Organization of Experiments: These studies were carried out in three separate experiments.

Experiment One was planted on March 16. Seeds were soaked in luke warm water for 10 to 12 hours before planting and germination occurred in 6 to 7 days. A culture of the fungus was started on April 2 and the seedlings were inoculated on April 14. The treated seedlings were then placed in two metal trays on a ground bed in the greenhouse with a randomized block design. The trays were covered with plastic sheets after inoculation, so the humidity around the plants could be maintained at a high level. The pots were watered when necessary by placing water in the metal trays. The plastic covers were removed after 72 hours. Temperature in the greenhouse during this period ranged between 58 and 90 degrees F. The fungus failed to produce symptoms on the seedlings. A fresh culture was started on April 27, and the plants were reinoculated on May 2. In this case symptoms appeared after four to five days and under very similar conditions to those described before. Infection records were taken on May 12 and 28. The results are reported in Table 2.

Experiment Two was planted in the propagation house due to lack of control over temperature and humidity in the main greenhouse. Since the Georgia strain of the fungus was obtained to be compared to the standard strain (Madison 11) this experiment was double that of the first experiment. The seeds were planted on June 2 and the pots were arranged on a concrete bench in the

propagation house with randomized block split-plot design. Fifty sterile test tubes containing frozen snap bean sections were inoculated with each pathological strain on June 15, and the plants were inoculated on June 21. After inoculation humidity was controlled by means of mist nozzles. The temperature ranged between 78 and 98° F. Symptoms of the disease were first observed on June 27. Infection records were taken on June 30, July 6 and July 19. The results are given in Table 3.

Experiment Three consisted of the inoculation of the  $F_1$  generation plants to determine the resistance of each hybrid to anthracnose. In addition to four crosses Black Diamond and Congo were also inoculated as susceptible and resistant checks respectively. Planting was done on September 11. Forty additional pots were seeded with Black Diamond and Congo for testing the Kansas strain of the fungus. Cultures of the Madison 11 and the Kansas strain were started on October 4, and the plants were inoculated on October 10. As in experiment one the pots were arranged on a concrete bench in the propagation house with a randomized block design. The concrete floor and bench were washed with a 1:1000 solution of mercuric chloride before placing the pots. Symptoms of the disease appeared on October 15. The results are reported in Table 4.

### Evaluation of Infection

The following standards were used to evaluate the degree of infection:

0-No infection, characterized by absence of symptoms of the disease.

1-Slight infection, characterized by a few spots or lesions on any above ground plant parts.

2-Medium infection, characterized by more lesions on the above ground plant parts.

3-Severe infection, characterized by presence of many lesions on the petioles and stem, but the plants were alive.

4-Very severe infection, characterized by prostration of the plant.

5-Death of the plant due to injury.

As soon as symptoms appeared on the seedlings, individual plants were inspected and rated by the above key. The degree of infection was averaged for each variety and date of inspection, and then an overall mean was calculated for each variety for all dates. Two to three observations were made at suitable intervals for each experiment.

### RESULTS AND DISCUSSION

#### Infection Studies

Age of Seedlings: The greenhouse studies indicated that the type of disease symptoms were closely related to age of the seedlings. Symptoms on seedlings which were ten days old at

the time of inoculation were markedly different from those on seedlings, two to five weeks old, Plate IV. On the younger seedlings infection was clearly visible on the leaves, first as irregular yellowish brown spots which later turned almost black. The spots enlarged until the whole leaf turned brown to black and shrivelled. Concurrently, lesions appeared on the petioles and stems of seedlings of the susceptible variety, Black Diamond. Plants of this variety were, for all practical purposes, killed by about two weeks after inoculation. In case of the resistant variety, Congo, the few spots that appeared in the beginning became static and did not impair growth of the plants to any appreciable extent. Lesions on petioles or stems of the resistant variety were hardly visible to the naked eye. Symptoms on three to five weeks old seedlings were seldom noticed on the blades of leaves. However, lesions were observed on stems at the ground level. These lesions, in susceptible varieties later killed the plants by coalescing and girdling the stems. Such lesions were few or missing on resistant varieties. Pink masses of spores could often be seen on the lesions.

Age of Culture: Apparently age of culture had a pronounced effect on pathogenicity of the fungus. In the first experiment a 12-day old culture failed to produce disease symptoms on one-month old seedlings. This failure was attributed to the culture being old, because on the same seedlings, under more or less similar conditions, a 5-day old culture of the same fungus

#### EXPLANATION OF PLATE IV

Symptoms of anthracnose on plants of different ages.

Fig. 1. Plants inoculated when 10 days old.

Left: 2 rows of Congo plants showing slight infection in the form of spots on the leaves.

Right: 2 rows of Black Diamond plants showing shrivelled leaves and the plants virtually dead due to the disease.

Fig. 2. Plants inoculated when 24 days old.

Left: Pot of Congo plants showing slight infection of anthracnose on leaves and stems.

Right: Pot of Black Diamond plants having been killed by the coalescence of lesions on stems at the ground level.

## PLATE IV



Fig. 1



Fig. 2

strain produced anthracnose symptoms five days after inoculation.

### Experimental Data and Interpretation

Table 2. Mean infection at 10 and 26 days after inoculation with the Madison 11 strain.

Variety	10 days	26 days
Black Diamond	1.70	4.72
Chris Cross	1.16	4.32
Charleston Gray	0.82	2.16
Fairfax	0.82	2.12
Congo	0.80	2.02
L.S.D. at 5% level	0.29	0.28

Varieties fall under two distinct groups. The resistant group included Congo, Fairfax and Charleston Gray, whereas Black Diamond and Chris Cross belonged to the susceptible group. Plate V.

Black Diamond was significantly more susceptible than any of the other four varieties.

Chris Cross was significantly more susceptible than any other variety but Black Diamond.

Table 3. Mean infection at 9, 15, and 28 days after inoculation with the Madison 11 strains.

Variety	9 days	15 days	28 days
	:Mad.11: Geo.	:Mad.11: Geo.	:Mad.11: Geo. :Mean
Black Diamond	3.78 4.98	4.28 5.00	4.62 5.00 4.61
Chris Cross	3.44 4.86	3.76 5.00	4.42 5.00 4.41
Charleston Gray	0.26 1.18	0.52 1.24	0.52 1.24 0.83
Fairfax	0.18 1.08	0.22 1.12	0.22 1.12 0.66
Congo	0.18 0.94	0.24 0.98	0.24 0.98 0.59
L.S.D. at 5% level = 0.16			

EXPLANATION OF PLATE V

Left to right: Anthracnose infection on plants of Chris Cross, Black Diamond, Fairfax, Congo and Charleston Gray. Three resistant varieties on the right show no lesions on stem, while the two susceptible varieties on the left show lesions on the stem at the ground level.

PLATE V



Within the resistant group there were no significant differences.

There were significant differences among varieties, strains of the fungus and significant interactions between strains and dates.

Major varietal differences existed between resistant and susceptible varieties.

There were minor differences between varieties within resistant and susceptible groups. For example: Charleston Gray is less resistant than Congo and Fairfax; but Congo and Fairfax are equally resistant. Black Diamond was more susceptible than Chris Cross.

Progress of the disease produced by the Madison 11 strain was slow and gradual but infection by the Georgia strain was quicker. The latter strain had produced about maximum injury to plants of the susceptible varieties in nine days, Plate VI.

Table 4. Mean infection at 9 and 15 days after inoculation with the Madison 11 strain.

Variety	9 days	15 days
Black Diamond x Charleston Gray	4.78	5.00
Black Diamond	4.56	5.00
Black Diamond x Chris Cross	4.56	5.00
Black Diamond x Congo	1.06	1.14
Fairfax x Black Diamond	0.50	0.72
Congo	0.44	0.70
L.S.C. at 5% level =	1.33	1.19

EXPLANATION OF PLATE VI

Comparison of virulence of two strains of the fungus 9 days after inoculation of plants which were 15 days old.

Fig. 1. Plants inoculated with the Georgia strain of the fungus.

Fig. 2. Plants inoculated with the Madison 11 strain of the fungus.

## PLATE VI



Fig. 1



Fig. 2

Neither pathogenic strain was able to seriously infect the resistant varieties, Congo, Fairfax and Charleston Gray by the twenty-eighth day.

The results indicate that of six strains, three were susceptible and three resistant. One susceptible strain was a cross between a susceptible and a resistant variety even though two other crosses between resistant and susceptible parents were resistant. Plate VII.

#### Inheritance of Resistance

Crosses between the two susceptible parents, Black Diamond x Chris Cross, as expected, produced completely susceptible plants. The other three crosses between susceptible and resistant parents, however, did not present a uniform picture. The crosses between Black Diamond x Congo and Fairfax x Black Diamond, each of which had one resistant parent, produced plants which possessed resistance approaching that of the resistant parent. However, in the cross between Black Diamond x Charleston Gray, transmission of resistance, to the  $F_1$  zygote from the resistant parent Charleston Gray was not the same as from the other resistant parents. All plants from this cross were highly susceptible.

Although there is no genetic basis to assume that Congo and Fairfax possess a similar gene or genes for resistance to anthracnose, present studies indicate a similarity of resistance in these two varieties. Apparently inheritance of resistance is due to a dominant gene or genes. However, that is not the case

#### EXPLANATION OF PLATE VII

Infection of the Madison 11 strain of the fungus on F<sub>1</sub> generation plants along with Black Diamond and Congo, 16 days after inoculation of plants which were 23 days old.

Left to right: Fairfax x Black Diamond, Congo, Black Diamond x Congo, Black Diamond, Black Diamond x Chris Cross and Black Diamond x Charleston Gray.

PLATE VII



in the cross between Black Diamond and Charleston Gray. All evidence indicated that the resistance in Charleston Gray is due to a different type of gene or genes from that of the other two resistant varieties. This variety was slightly less resistant than Congo or Fairfax in these experiments and its  $F_1$  progeny plants were all susceptible. It is, therefore, believed that resistance in Charleston Gray is controlled by a recessive gene or genes.

## SUMMARY AND CONCLUSIONS

Only a fresh culture of the fungus, not older than a week, gave uniform and satisfactory results. A twelve-day old culture failed to produce infection.

The dunking technique of inoculating plants gave highly uniform and satisfactory infection.

Symptoms of the disease in the greenhouse were found to differ due to the age of the seedlings. Infection on seedlings less than 10 days old was mostly on foliage, later spreading to petioles and stems. This type of infection was inconspicuous on seedlings 3 to 5 weeks old. In the latter case, infection was more prominent on the stems, especially at the ground level.

The Georgia strain of the fungus proved more virulent than the Madison 11 strain, because it was faster in action. Injury by the Georgia strain at the end of a week was equal to that of the Madison 11 strain at the end of three weeks.

It was noticed that infection up to 2 degrees did not impair growth of the plants to an appreciable extent, but infection of higher degree would either seriously injure or kill the plants. Hence a line of demarkation between susceptible and resistant varieties was drawn at that point.

Out of the five commercial varieties screened for resistance, Black Diamond and Chris Cross proved susceptible and Charleston Gray, Congo and Fairfax resistant to anthracnose.

Chris Cross which has been claimed to be resistant to anthracnose was not found to be so in these experiments. On

the contrary, the plants were found to be very susceptible. The minor difference of susceptibility between Chris Cross and Black Diamond was apparently due to a slower rate of action of the pathogen on Chris Cross, but the ultimate injury was almost equal in both varieties.

Congo and Fairfax were found to be equally resistant. Resistance is dominant over susceptibility in these varieties. This conclusion is substantiated by the fact that the  $F_1$  generation plants of crosses with Black Diamond were equally resistant.

Even though, Charleston Gray proved to be a resistant variety, the  $F_1$  plants from a cross with Black Diamond were susceptible. It indicates that this variety does not possess the same kind of resistance as the other two resistant varieties, Congo and Fairfax. Resistance in this case seems to be of recessive nature.

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AN ABSTRACT OF THESIS

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requirements for the degree

MASTER OF SCIENCE

Department of Horticulture

KANSAS STATE COLLEGE  
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1957

Plants of the watermelon varieties Black Diamond, Chris Cross, Congo, Fairfax and Charleston Gray were grown in pots in the greenhouse and inoculated with a common type of the fungus Colletotrichum lagenarium (Pass.) Ell. and Hals., Madison 11 Strain, to determine the relative resistance of each to this fungus causing anthracnose of watermelon.

Crosses were then made between Black Diamond, which was highly susceptible, and each of other varieties to determine

- (1) Which variety would be the best source of resistance
- (2) The mode of inheritance of resistance.

From the first series of experiments it was found that Congo, Fairfax and Charleston Gray were all resistant to anthracnose, but that Charleston Gray was slightly less resistant. Both Black Diamond and Chris Cross were highly susceptible.

The first generation plants of crosses with Congo and Fairfax were found resistant indicating that resistance in these two varieties was dominant over susceptibility. The plants of the cross with Charleston Gray were, however, susceptible indicating that resistance in Charleston Gray was due to a different type of gene or genes which is of recessive nature.