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**BULLETIN NO. 17, - - - - JULY, 1890.**

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**Agricultural Experiment Station,**  
OF THE  
**Agricultural and Mechanical College,**

**AUBURN, ALA. - - - - - JULY, 1890.**


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**Dry Application of Paris Green and London Purple for the  
Cotton Worm.**

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REPORT OF ALABAMA WEATHER SERVICE.

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THE DRY APPLICATION OF UNDILUTED PARIS  
GREEN AND LONDON PURPLE FOR THE  
COTTON WORM.

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GEO. F. ATKINSON, Biologist.

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In order to obtain an expression of opinion from some of the practical cotton growers of the State, in regard to the value of a recent method of the dry application of Paris-green or London purple, for the destruction of the cotton worm (*Aletia xyliana*), one hundred circular letters were sent to prominent farmers in the southern portion of the State. Since but few have as yet tried this method the letters were sent "at random," not knowing whether the party addressed had given it a trial.

Up to date of this writing (June 9), twenty-five replies have been received, a very large percentage considering the probable fact that many, not heard from, are unacquainted personally with the method. Of this number four had not applied the poison according to the method described; of the twenty-one who had, only *one* spoke unfavorably of it; the twenty who favored this method of application were very emphatic in declaring it to be, all things considered, the very best method yet known.

In view of this remarkable consensus of opinion as to the cheapness, ease of application, and the effectiveness of this method, and the very intelligent character of the replies, it has been deemed wise to publish a bulletin for the farmers of the State based entirely upon the information gained by means of the circular letter.

Following is the letter :

CIRCULAR LETTER.

AGRICULTURAL EXPERIMENT STATION, AUBURN, ALA., May 14, 1890.

Dear Sir—In view of the importance of any improved method in the application of Paris Green or London Purple to cotton for the destruction of the cotton worm, you are respectfully requested to answer the following questions in regard to the dry application of the poison which, according

to a recent method, is allowed to dust through osnaburg bags suspended at the end of a pole, the pole being carried by a man mounted on a mule, and the animal trotted across the field. If you have not tried this method will you please hand this circular to one of your intelligent neighbors who has and request him to forward the answers to us. For this purpose a stamped envelope is enclosed.

1. Did you use the Paris green pure, that is, unmixed with any other substance, or did you mix with plaster of Paris, or flour, etc? If so, in what proportion?

2. What was length and size of pole used?

3. Size of bag and material used for bagging?

4. How many rows will be poisoned by one passage across the field?

5. Does the poison float about long enough in the air to poison the under side of the leaves as well as the upper side, or is only the upper side of the leaves poisoned?

6. To what extent does the wind interfere with its application?

7. Will it answer to apply it at any time during the day, or must it be applied when the cotton is wet with either dew or rain?

8. What amount of Paris green is required per acre?

9. How many acres will one man poison in a day?

10. How many applications did you make during the season?

11. Do you consider this method of application so effective in killing the worms as spraying with Paris green water? and will you try it again this year if the worms are troublesome?

12. Do rains wash off the applications?

13. Is the man applying it, or the mule, in any danger of being poisoned? If so, would not a wetted sponge tied over the mouth and nostrils prevent any danger?

14. Is there any danger of poisoning stock which are feeding in adjacent pastures and fields?

15. Did you use Paris green, or London purple, and which, do you consider the better poison to use, all things considered?

Why?

Please write the answers to the above questions in the space after each one, and on a separate sheet of paper kindly add any information regarding your trial of this method which you may think of value.

An early reply will be appreciated. Very respectfully,

GEO. F. ATKINSON, Biologist.

The names and addresses of those who had tried the method are as follows:

Hon. Jas. G. Gilchrist, Hope Hull, Ala.

C. S. G. Doster, Prattville, Ala.

J. H. Redding, Gallion, Ala.

John P. Streety & Co., Hayneville, Ala.

J. V. Tutt, Belmont, Ala.

Maj. I. F. Culver, Union Springs, Ala.

Hon. H. B. Inge, Greensboro, Ala.

Wm. H. Miller, Union, Ala.  
 H. A. Stollenwerck, Uniontown, Ala.  
 W. F. Strudwick, Demopolis, Ala.  
 W. E. Browning, Pleasant Hill, Ala.  
 J. W. Edmunds, Faunsdale, Ala.  
 B. L. Garber, Laneville, Ala.  
 Hon. G. R. Banks, Tallassee, Ala.  
 Walter Bros., Woodley, Ala.  
 Jas. A. Speir, Furman, Ala.  
 S. M. Cathcart, Alberta, Ala.  
 Unknown. Letter mailed on Cleveland and Selma R. R.  
 Hon. A. C. Davidson, Uniontown, Ala.  
 Hon. Mims Walker, Faunsdala, Ala.  
 J. Orum, Fitzpatrick, Ala.

The replies have been tabulated and are presented in that form on the closing pages of this article. Instead of repeating the questions the numbers only appear in the table, the answers to each underlying the number in the proper column. I found it necessary to abbreviate a number of the answers in order that they might appear in a tabulated form. Therefore, for an intelligent understanding of the table it will be well to make some remarks upon the nature of the replies and their practical bearing. At the same time an opportunity will be had of quoting more fully some of the more important parts of the replies, as well as some valuable additional information offered by a few, on a separate sheet.

It will be noticed that only one (Mr. Miller) diluted the Paris green, using 5 lbs. flour to one of Paris green. The remarkable thing about the use of the diluent here is that more Paris green was used per acre (3-5 lbs.) than by any one who used it "pure." It will also be noticed that although the pole was seven feet long the number of acres covered per day (column 9) was less than that reported by any one else, even where the pole was only half so long. However, the number of acres per day is not a very good criterion for it is largely dependent upon the rapidity with which the man works, and the aids he has in filling the bags, as well as the time of the day devoted to the work. Mr. Miller prefers to apply it when the plant is damp, and perhaps did not keep the man at work all day. In column 4

we probably have the chief reason for the greater amount of Paris green and the less number of acres covered per day. One passage across the field covered "two middles," which is equivalent to two rows, so that the pole lapped over about one-half of each previous application, whereas a pole three ft.—four ft. long—according to others, covers two rows, while a pole eight feet long covers from 4—10 rows. It may be that when mixed with flour it does not "float" in the air so long, or so far, but falls more quickly to the ground, and hence cannot cover so much ground at one passage as a pole of equal length used with undiluted Paris green. Until the two methods have been compared with a view to settle this question the suggestion given above is all that is warranted.

The favorite length for the pole seems to be about 8 feet. The Hon. H. B. Inge, and the "unknown" gentleman use a narrow board, or "plank," 1 x 4, or 1 x 3, inches. In this case I believe a hole is bored through each end of the "plank," where a stopper can be inserted, and the bag is stacked by the edges around the hole, where it can be easily filled. The former gentleman cuts a place in the middle to fit the hand but not enough to make the "plank" limber.

It will be seen that the size of the bag varies a great deal also. Some of these need explanation. That used by Mr. Redding, for instance, is 30 inches long, but it is open at each end until slipped on to the end of the pole, and then, when filled, is tied around the pole at each end by a strong cord. Mr. Tutt places the 12 inch side against the pole and stacks it on. Some fasten the bag with a strong draw cord.

Except in two cases the material used is 8 oz. osnaburg. J. P. Streey & Co., use "Brown shirting." It may be that this material is especially adapted to dust the London purple which they now use altogether. The material used by Mr. Browning is a good illustration of what may be done on short notice when the desired material is not at hand. He says, "I used the meal sack that had been washed and ironed. It was folded and sewed up at sides and pinned on end of pole with locust thorns."

For columns 4, 5, 6 and 7 little may be said other than appears in the table. It is worthy of note, however, that a

considerable quantity of the poison lodges on the under side of the leaves, a very important feature of the method, for the worms may be killed while very young, when they only feed on the under surface of the leaves.

From column 8 it is evident that in a number of cases there is a great waste of the poison. The Hon. A. C. Davidson says, "it takes too much to be in general use," but with a pole 8 ft. long he counts the rows poisoned at one passage as only two. Compared with what the 8 ft. pole is shown to do in other cases he could reduce the cost so that it would be only about one-fourth that experienced by him. Mr. Tutt says there is more danger of putting on too much than too little. A number of the replies indicate very truly that the amount varies with the size of the cotton.

Nearly all agree that rains wash off the applications more or less, varying with the amount of rain. Mr. Orum states that 24 hours after the application the rain does not wash off the poison. Probably he thought not because the worms were killed. If rain does not come for several hours after application most of the worms are killed, especially when young.

Question 13 is not stated as it should have been, owing to the fact that I had been informed upon this point by questionable rumors. It seems that the danger lies chiefly in the poison coming in contact with some part of the body which is chafed either by clothing or by riding. The replies indicate that it can be prevented by care in covering such parts well, or by moving rapidly enough to keep out of the cloud of dust, and then at night give both man and mule a bath, and the man a change of clothes.

In column 14 the replies show that there only is danger when a heavy wind is blowing towards the pasture.

In reference to the use of Paris green or London purple there will always be some individual preferences for the one or the other. The cheapness of London purple and the fineness of the powder will always recommend it to some, while the more speedy action of the Paris green will cause the latter to be the favorite of others. Paris green is especially desirable when rain is anticipated soon after the application, for, in many such cases if London purple were

used a second application would be necessitated after the rain, whereas in many similar cases the more prompt action of Paris green would kill the worms before the rain.

It will be well to carefully read the quotations given below, especially that of J. P. Streety & Co., since they are very large producers of cotton, and are the only ones thus far heard from who prefer to use London purple, which they do successfully. It might be well to keep both the Paris green and London purple on hand, and if there was no indication of rain soon to use the London purple, but if rain is feared soon, to use the Paris green :

The following quotations bear on various questions in the circular, which were too long to incorporate in the table :

FROM HON. JAS. G. GILCHRIST.

“My principal reason for preferring this method to any other is the rapidity and simplicity of application. There is no water to draw and haul, no machine to get out of order at an important time, and nothing to prevent poisoning from beginning the very instant that the young worms appear on the cotton. The bags can be kept ready filled in a dry place, and by keeping a strict watch on the spots where worms first appear they can be effectually checked before they have done any harm.

“In answer to question five, I will state that when the poison is put on at the right time, when the young worms first hatch out, it kills them in the course of one or two hours and this makes me believe that the dust must settle on every part of the plant. When the poison is applied to cotton infested with young worms early in the morning, the worms can be seen by the thousand, in a few hours, hanging dead from the plant by a string of web.”

“Since I began using this method, my cotton has suffered but little from the ravages of the boll worm, and I am satisfied that it kills them as well as the cotton worm.”

“The poison seems to settle all over the plant, and for this reason, much more poison can be applied without danger of scorching the plant, *enough to kill every one of the worms*. This is a result which I was never able to secure by the old sprinkling method.”

“The ease with which the poison can be washed off by showers or shaken off by high winds would seem to be a disadvantage, but its action is so prompt that few hours of suitable weather is all that is necessary to exterminate one crop of worms.”

FROM C. S. G. DOSTER.

“Last summer I abandoned the mule and put my *poisoners* on foot, which I found to be slower but much safer and more efficient.”

FROM JOHN P. STREETY & CO.

“We have been engaged for many years in making and handling cotton and have tried every method of killing the caterpillars. Our present opinion is that the use of London purple dusted on as described in your circular is, all things considered, much the most satisfactory method we have ever



tried. We think it best to poison only two rows at one go; and under fair conditions we have gone over 20 acres a day to the mule. We find it necessary to use a saddle and a folded sack for the protection of the mule and comfort of the rider. Care must be taken to wash, and sometimes grease the mule where the poison may have settled on it. There is we think no danger from inhaling the poison. We have been for many years largely engaged in raising and handling cotton and have of course given the matter our best attention. Last year, (1889-90), we made and handled over two thousand (2000) bales of cotton, and found it very necessary to watch our interest."

FROM HON. H. B. INGE.

"I have been trying to poison the cotton worms for the last 15 to 16 years with Paris green in water applied with various kinds of pumps, but it has always been doubtful whether it paid as it was troublesome, dangerous, uncertain and laborious. But with the pole and bag a man and horse can poison in a day what land the latter can work by keeping him supplied with poison so he would not have to stop to refill. It takes very little poison to do the work, much less than we generally use. If applied when the worms are quite small it takes but a little while to kill them all. The result of my experiment with dry green last year was most satisfactory to me as well as to most of my neighbors. Some claim that it kills the boll worm also, but I doubt that as my crop on one plantation was very materially injured by the boll worm and the army worm did but very little damage."

FROM WM. H. MILLER.

"Must tie up neck and legs well, also must protect shoulders of mule."

FROM H. A. STOLLENWERCK.

"I have poisoned every year since the appearance of the worms. I have used arsenic, London purple and Paris green: have used them with flour and also with water and have abandoned all methods and materials except the Paris green and use this without any mixture. I use it with the bags and pole and also with a distributor that is worked with two mules and driver. With it I poison 60 acres per day. At the proper time, just as the worms are hatching and before they do any damage I start my 'Distributor' which takes only one hand and two mules; also start 6 hands with the poles and bags and go over 120 acres. I poison at least 175 to 200 acres daily and in three days poison my whole crop."

"I wash off my mules at noon and also at night and keep the hands protected and have never had either poisoned. I use double the quantity of Paris green that I did when I mixed with flour. The use of Paris green alone is less expensive than when mixed with flour."

"I do with 6 hands what I formerly did with 30, and do it more quickly and equally as effectively. The worms usually come in fodder pulling time and to save the cotton the fodder had to be abandoned. Now I save both."

"The dry poison kills the worms. If it rains before the second brood hatches I apply the second time. I applied the second time on my bottom lands and the cotton remained green until frost. On the uplands that had matured I did not apply the second time and the worms stripped it."

FROM W. E. BROWNING.

"I could not be induced to use the poison any other way than with the sacks and pole."

## FROM J. W. EDMUNDS.

"I poisoned with the 8 oz. osnaburg bags in 1888 and last year, and saved my crop entirely from the ravage of the leaf-worm. I don't expect to use anything else unless something comes along that I am *satisfied* is better."

"If a rain comes up 5 or 6 hours after application I am satisfied fully one half if not two-thirds of the worms are destroyed, and 10 or 12 hours gets them all."

"In 1888 I used 3 lbs. Paris green per acre, but last year I only used 2 lbs. per acre and the effect was the same, killing all the worms."

"The dust of the poison will get all in the animals hair close to the skin and it looks as if it would injure the stock; but it does not. Care must be taken not to let the mules lick one another for a few days."

"The bags should never get the *least* damp or the poison will not come through. I used a strong draw string at the top, or mouth, of the bag. Some persons used as much as 4 lbs. per acre in this section, but that is all thrown away. I believe with careful handling 1½ lbs. per acre will be sufficient."

## FROM B. L. GARBER.

"We have been using Paris Green since 1873. Have been successful with Paris green, but never so with arsenic or London purple. Have burned up acres with arsenic and scorched more with London purple. Have applied it in all shapes and forms and think the dry application the best. It is a matter of dispute with us as to its being put on while cotton is damp or dry. I think while dry is better as naturally it will be diffused so much more while the atmosphere is dry than while damp. The Roach machine is the best to apply it with. The objection a great many give is cost—\$70.00."

(The machine referred to is the "Roach's Cotton Worm Destroyer," Jas. P. Roach Manufacturing Co., Vicksburg, Miss. It is sold by M. Wilkins, Faunsdale, Ala.)

## FROM HON. G. R. BANKS.

"Think the dry process is very much less injurious than the water—and is certainly much more rapid. As it requires quick work to rid yourself of the worm before damage, I have concluded it to be the best method and will use it again this year. Have never used the purple to any extent. It may do as well as green—would like to hear from some one who has used it successfully."

## FROM JAS. O. SPEIR.

"I prefer to apply with one man walking, putting in sack 1½—2 lbs green and tapping it as he walks along rapidly. The man can also avoid the poison better by shifting the sack so that the dust will not collect or fall on him."

## FROM S. M. CATHCART.

"I poisoned my entire cotton crop last year with dry Paris green. It is a great improvement over the old method of poisoning with Paris green water. An expert hand can poison a one mule crop in two days. As soon as get through poisoning every day require the hand to change clothes, and wash the mule off thoroughly. If the proper precaution is taken there is no danger of being poisoned."

## FROM HON. A. C. DAVIDSON.

"I shall abandon all methods of using the dry Paris green except through the instrumentality of the machine made at Vicksburg, Miss. In the early

part of the season, I will no doubt use Paris green and flour as I have done since 1873, in the proportion of 10 lbs. Paris green to 1 bbl. flour, applied through perforated tin sifter."

(The objection shown in the table seems to be to the use of the "bags and pole.")

#### FROM JAS. ORUM.

"I used a pole 8 ft. long and about  $1\frac{1}{4}$  inches square, bored a  $\frac{3}{4}$  inch hole in each end, tacked the sacks on the ends of the pole, and after putting in Paris green stopped the holes."

As Prof. J. S. Newman, Director of the Experiment Station, has had an opportunity of testing the use of dry Paris green, and London purple for the cotton worm, on the Station farm, he has prepared, at my request, the following statement of his experience :

"Cotton worms rarely appear in this locality in sufficient numbers to seriously injure the crop. In 1883 they were numerous enough to destroy the leaves from late cotton."

"A rude experiment was made in poisoning them with different liquid preparations. Kerosene emulsion, arsenic, London purple and Paris green were used, each on one-fourth of an acre, and a strip between them left without poison. The Paris green and London purple were each used, one pound to fifty gallons of water, and one pound to one hundred gallons. Having no sprayer the liquid was applied by means of a bunch of "bitter weed" (*Helenium tenuifolium*), which was dipped into a bucket of the liquid and shaken over the plants."

"The kerosene was churned with milk instead of soap-suds."

"The arsenic was prepared as follows: Five pounds of arsenic were dissolved by being boiled in five gallons of water, to which was added one pound of sal soda. A pint and a half of this solution was diluted with forty gallons of water, and thoroughly stirred before using. All of these preparations destroyed the worms, while the leaves were stripped where no poison was used."

"The arsenic scalded the leaves and the kerosene emulsion injured the tender buds of the cotton. No injury resulted from the use of either the London purple or the Paris green, while the more dilute of each was as effective as the stronger mixture."

#### PARIS GREEN AND LONDON PURPLE USED DRY.

"In 1887 the worms again appeared in force. As soon as the worms were discovered on the bottom leaves of the plants from  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in length, the purple and green were each dusted over one-third of the cotton in a half acre lot, the third across the center receiving none. The effect of each was satisfactory in destroying the worms, but the London purple injured the leaves, which received an over-dose. No injury to the plant from the use of the Paris green was observed. A piece of common shirting was tacked loosely to the sides of a six inch plank, four feet long, forming a sack. A hole bored into the plank with a  $\frac{3}{4}$  bit served to admit the poison. The sack covered one-third of the plank—the balance was trimmed so as to be readily handled. A man on foot, holding the plank in

one hand over a row of cotton, tapped it gently with the other. The fine powder seemed to be very well distributed to every part of the plant, as every worm was destroyed before perceptible injury was done."

"The eggs of the Aletia are deposited on the lower leaves of the plant and the young caterpillars are not readily discovered until they are several days old and have commenced to feed upon the tender upper leaves."

"They usually make their appearance early in rank cotton where they spend their early existence upon the lower leaves, which are well shaded."

"By walking through such cotton, when their presence is suspected, the small caterpillars adhere to one's pants, and may thus be detected even when they escape a diligent search directed to the plants themselves."

All cotton growers will read the matter presented above with great interest. It is a comparison of the results of a recent method of applying Paris green and London purple obtained by men who live at too great a distance from each other to make these comparisons without the aid of a bulletin on the subject. The details of the results vary, and in this way one man's experience will assist another until by careful attention to all the details the expense can yet be reduced, and the value of the method increased.

It may be well at this point to summarize the chief advantages which this method presents.

The inexpensiveness of the outfit puts it within reach of every cotton grower. Cotton growers in localities rarely visited by the worms are not warranted in keeping on hand machinery even though it cost but a few dollars. The "bags and pole" cost too little to be considered.

The quickness with which the work can be started and the rapidity with which it can be carried on make it possible to kill the worms before they have done any harm.

The poison can be applied without difficulty when the soil is so soft from rains as to make it impossible to go into the field with heavy machinery.

It is as practicable for the man who has only one acre of cotton as for one who has a thousand or more. This is one of the greatest advantages of the method, for, according to former methods, the cost of machinery would nearly equal the value of a small crop.

With proper precautions it is no more dangerous than when the Paris green is applied with water.

Among very large cotton growers, the Roach's machine

manufactured at Vicksburg, Miss., may be preferable, since it poisons from 60 to 80 acres per day, with one man and two mules, and can be made very economical in the amount of Paris green or London purple used. The great objection, as stated in one of the letters, seems to be the cost. It distributes the unmixed poison and blows it away from driver and mules.

In conclusion, it may be of service to state very briefly the habits of the parent moth in egg-laying, and of the young larvæ, for it is very important that these points should be well understood in order to make the application of the poison at the earliest moment to insure killing the worms while young.

The moth deposits her eggs at night. She deposits them singly upon the underside of the leaf. Some times three or four eggs are laid upon one leaf, rarely as high a number as thirty or more. She selects the most vigorous or succulent cotton and deposits the eggs on the lower leaves of such plants. When the cotton is older, later in the season, she deposits eggs on the upper leaves also.

In favorable weather the eggs hatch in three to four days to one week. The young worms at first feed only on the underside of the leaves, not biting through the leaf, so that neither they, nor their work, are easily seen until later when they eat entirely through the leaf.

By taking advantage of the habits of the moth and young worms the spots may easily be found where they first attack the cotton. For finding the young worms the reader is referred to the method described by Professor Newman in the article I have quoted from his pen.

I wish here to express my thanks to the gentlemen who have so kindly and promptly responded to the questions in the circular letter, and also to those who have taken the trouble to interest others in the matter when they themselves were unacquainted with the method.

The following are the tabulated answers to the circular letter.

name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
G. christ.	Pure.	8 ft. long, 1½ in. in diameter.	6x8 inches, osnaburg.	4-6	Most on upper side.	Calm day better.	Early morning, late evening.	2-4 lbs.	20	2	Yes,	Yes.	Moving rapidly no harm.	Think not.	Have used both, prefer Paris green,
S. G. oster.	Pure.	3-4 ft. long, 1 in. in diameter.	To hold ½-¾ gallons, osnaburg.	2	Most on upper side.	Very much.	When wet by dew or rain.	1-4 lbs.	8-12	2	Yes.	Yes.	No.	No.	Paris green more efficient.
H. dding.	Pure.	9 ft. long, 1½ in. diameter.	30 inch. long, osnaburg.	4-6 and 8-12	Both sides.	Benefit if not too strong.	Any time.	No reply.	25	2 generally	Yes.	To some extent.	Move to keep out of dust.	No.	Paris green; London purple blows off leaf too easily.
V. V. fultt.	Pure.	8 ft. long, 2 in. diameter.	12x6 inches, osnaburg.	6	Both sides.	High wind seriously.	Early morning, late evening.	2 lbs.	10	No reply.	Yes.	Yes.	Causes sores by contact,	Not in calm days.	Paris green, more effective.
P. reety.	Pure.	5 ft. long.	To hold 3 lbs. brown shirting.	2	Both sides.	Considerably.	All day; better when damp	1 lb.	15	2-3	Yes.	Yes.	Danger from contact.	No.	London purple; finer and cheaper.
F. ulver.	Pure.	8½ ft. long.	6x10 inches, osnaburg.	4	Both sides.	High wind seriously.	Early morning, late evening.	½ lb.	40	1	Yes.	Yes.	None with care.	Not unless w'd blows towards it	Paris green, never used London purple
B. nge.	Pure.	8-9 ft. long, 1x4 inches.	10x4 inches, osnaburg.	8-10	Both sides	Prefer a light wind.	Better when dry; bag is ruined if it gets wet.	1-1½ lbs.	25-30	2	Yes.	Heavy rains, etc	Not with care.	Think not.	Paris green, never used London purple
H. tille.	5 flour to 1 Paris green.	7 ft. long.	8x6 inches, osnaburg.	2 middles	Both sides.	High wind seriously.	When damp.	3-5 lbs.	6-10	2	Yes.	Yes.	Not with care.	Think not.	Paris green, more prompt.
A. Stolwerck.	Pure.	8 ft. long.	To hold 1½ lbs. osnaburg	4	Very little on underside.	Light wind no objection.	Any time, better when damp.	1½-2½ lbs.	20	1-2	Yes.	Yes.	Causes sores.	Think not.	Paris green, more prompt.
V. F. idwick.	No reply.	8 ft. long.	Osnaburg.	4-6	Most on upper side.	Seriously.	Any time, better when damp.	No reply.	16-20	No reply.	Yes.	Yes.	No more than with water.	Think not.	Paris green, more effective.
V. E. wning.	Pure.	7 ft. long, a large dry cane.	Meal sack folded.	Passed in every 3rd row.	Most on upper side.	Light wind favorable.	Any time.	1½ lbs.	20	1	Yes.	Yes.	To some extent.	Think not.	Paris green.
W. nunds.	Pure.	8 ft. long, 2½ in. diameter.	8x6 inches, osnaburg.	3	Most on upper side.	High wind prevents uniformity.	All day.	2 lbs.	20	2	Yes.	If it rains soon.	No.	Think not.	Paris green, kills quickly and does not scorch cotton.

L. ber.	Pure.	8-9 ft. long, 1½ in. diameter.	1 yard for 4 sacks, osnaburg.	4-6	Most on upper side.	None if in right direction	Any time, better when dry.	1½-3 lbs.	10-15	2-3	Yes.	To some extent.	Danger of sores.	Not if wind in right direction.	Paris green, more effective.
R ks.	No reply.	No reply.	14x8 inches, osnaburg.	4-6	Both sides probably.	High wind seriously.	Early morning, late evening.	1½-2 lbs.	No calculation.	2 usually.	Yes.	Yes.	If body not protected.	Not if wind in right direction.	Paris green, never used L. purple to any extent.
ter hers	Pure.	5 ft. long, 2 in. in diameter.	6x12 inches, osnaburg.	2	Both sides.	Calm day better.	Any time.	2½-3 lbs.	15	1-2	Yes.	Yes.	Danger wh're rider touches mule.	No.	Paris green, more effective.
A. ir.	Pure.	3 ft. by hand, 4 ft. on mule.	10x12 inches, osnaburg.	1 by hand 2 with mule.	Most on upper side.	High wind seriously.	Any time.	1 lb.	On foot 8-10 with mule 12-15	1 usually.	Yes.	Heavy rains do.	Causes sores on body.	No.	Paris green, more effective.
M. bart.	No reply.	4 ft. long, 1¼ in. diameter.	8x8 inches, osnaburg.	2	Most on upper side.	High wind seriously.	Any time.	2 lbs.	10	2	Yes.	Yes.	Some.	Think not.	Paris green, never used London purple
own	Pure.	6 ft. long, 1x3 inches.	To hold 1 qt. osnaburg	4	Both sides.	High wind seriously.	Any time.	No calculation.	15	1	Yes.	No.	Yes.	No.	Paris green, more effective.
son.	Pure	8 ft. long, size broom handle.	8x4 inches, osnaburg.	Count it 2.	No examination.	Very largely.	All day.	Too large a quantity.	10-12	2-3	For w'rm man and mule.	Yes.	Causes sores.	Do not know.	Paris green, London purple scorches cotton.
is er.	Pure.	8 ft. long, 1½ in. diameter	6x12 inches, osnaburg.	4	No examination.	High wind seriously.	Any time, better when damp.	1-2 lbs.	15-20	1	Yes.	No more than the mixture.	Yes.	never heard of any.	Paris green, never used London purple
am.	Pure.	8 ft. long, 1¼ in. diameter.	8x6 inches, osnaburg.	6	Both sides.	High wind seriously.	Any time, better when damp.	Do not know.	15-20	1	Yes.	Not after 24 hours.	Yes.	No.	Paris green, never used London purple

Appendix to Bulletin No. 17, of the Alabama Experiment  
Station.

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R E P O R T  
OF THE  
ALABAMA WEATHER SERVICE.

Co-operating with the U. S. Signal Service.

MAY, 1890.

STATE POLYTECHNIC INSTITUTE, }  
Auburn, Ala., June 15th, 1890. }

In North Alabama the frost on the 8th of May damaged young vegetables and slightly retarded the growth of corn. In the middle portions of the State, however, this frost was very slight and hardly perceptible.

The cool nights during the first part of the month were favorable for the multiplication of cutworms and lice, and in some parts of the State farmers have complained about the attacks of these insects. The average temperature was  $2.8^{\circ}$  degrees below the normal. The amount of rain over the entire State during the month was large, being about 1.41 inches above the normal. This increase in rain has given a considerable impetus to the growth of cotton and corn, and the pleasant days towards the close of the month have largely aided the cotton plant in recovering the growth lost during the first of the month. The farmers are well up with their work over the State, although the recent rains have caused the grass to grow very rapidly.

J. M. QUARLES,  
Assistant.

P. H. MELL,  
Director.

STATE SUMMARY.

ATMOSPHERIC PRESSURE (*in inches*).—Monthly mean, 29.992; maximum observed, 30.357, at Chattanooga on the 8th; minimum observed, 29.628, at Auburn on the 5th; range for the State, 0.729.

TEMPERATURE (*Degrees F.*)—Monthly mean, 69.4; highest monthly mean, 72.7, at Mobile and Union Springs; lowest monthly mean, 64.9, at Gunter'sville and Chepultapec; maximum 92, at Gadsden and Citronelle on 31st; minimum, 34 at Double Springs on the 8th; range for the State  $61^{\circ}$ ;



greatest local monthly range 57 at Double Springs; least local monthly range, 35, at Chepultapac.

PRECIPITATION—Including melting snow (*in inches*).—Average for the State, 5.37; greatest, 10.19, at Montgomery; least 1.32 at Guntersville.

WIND.—Prevailing direction, southeast.

AMOUNT OF WIND DURING MONTH (*in miles*),—Auburn, (from 12th to 31st) 1855; Chattanooga, 3206; Mobile, 6055; Montgomery, 3536.

MEAN HUMIDITY.—Auburn 70 3; Montgomery, 69.

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#### NOTES FROM OBSERVERS.

*Double Springs* (A. M. Weiler). The past month has been favorable for the farmers, and crops have grown off well. The rainfall has been above an average; but no destructive storm has gone over this county.

*Greensboro* (M. H. Yerby).—Crops of all kinds are doing moderately well, although the nights have been rather cool for cotton. The entire fruit crop is a failure. The melon crop is not very promising at present. More rain is needed for the oat crop.

*Jasper* (Howard Lamar).—There was lightning in the north at 9 p. m. 7th. Strong west wind all day; quite cool, and fires necessary; heavy frost. 10th, heavy wind and rain storm 7 p. m. to 9 p. m.; constant lightning in South. 19th, thunder storm with a few hail stones about 2 p. m.

*Tuscumbia* (L. B. Thornton).—May 1st, lightning in southeast at 9 p. m. 6th, hail at 7 p. m., with thunder cloud. 10th, thunder cloud at 5 p. m. and lightning. 12th, lightning in west and east at 9 p. m. 18th, continued lightning in northeast at 9 p. m. 19th, thunder cloud with heavy rain at 10 a. m. 24th, rain inappreciable, thunder cloud in west at 3 p. m.

Monthly Summary of Meteorological Reports by Voluntary Observers of the Alabama Weather Service, May, 1890.

STATIONS.	COUNTIES.	Altitude.	Latitude N.	Longitude W.	BAROMETER.				TEMPERATURE.						Total Precipitation	Clear Days.	Fair Days.	Cloudy Days.	Days of Rain.	Prevailing Wind.			
					MAX.		MIN.		Monthly Mean.	Mean of Max.	Mean of Min.	MAX.		MIN.							Monthly Range.	Me'n Daily Range	
					Height.	Date.	Height.	Date.				Degrees.	Date.	Degrees.									Date.
Tuscumbia.....	Colbert.....	498	34 42	87 38	.....	.....	.....	66.9	77.2	62.1	88	31	45	8	43	15.1	3.71	16	15	0	9	W	
Valley Head.....	DeKalb.....	1058	34 30	85 30	.....	.....	.....	65.6	79.8	51.4	85	31	41	7	44	28.4	4.78	22	8	1	10	W	
Gadsden.....	Etowah.....	.....	34 02	86 02	.....	.....	.....	68.9	81.3	56.5	92	31	58	8	34	24.8	5.08	.....	.....	.....	7	.....	
Florence.....	Lauderdale.....	.....	34 48	87 37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chattanooga.....	Tennessee.....	783	35 03	85 14	29.999	30 357	8 29 911	5 68	78	58	89	31	40	8	49	20	3.95	12	13	6	13	W	
Montgomery.....	Montgomery.....	219	32 22	86 23	30 022	30 332	8 29 730	5 73	82	61.9	89	34	45	8	44	20.6	10.19	8	15	8	15	E & Sw	
Tuscaloosa.....	Tuscaloosa.....	240	33 12	87 42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Union Springs.....	Bullock.....	516	32 12	85 39	.....	.....	.....	72.7	77.7	76.3	85	24	55	8	30	19.4	4.99	8	11	12	7	W	
Bermuda.....	Monroe.....	.....	31 43	87 12	.....	.....	.....	69.1	79.8	63.3	85	112.24	51	7	34	26.8	7.06	.....	.....	.....	.....	.....	.....
Mobile.....	Mobile.....	30	30 41	88 20	29.995	30 310	8 29 787	4 73.7	81.1	64.3	87	31	31	8	33	26.7	5.50	9	13	9	11	W	
Auburn.....	Lee.....	826	32 40	85 30	29.973	30 341	8 29 628	5 71.2	81.2	61.2	87	25	42	8	45	20	6.18	17	6	8	10	W	
Livingston.....	Sumter.....	150	32 34	88 05	30.002	30 027	8 29 770	5 70	83.0	61.3	87	2-31	45	8	48	20	4.15	12	9	12	9	W	
Greensboro.....	Hale.....	220	32 41	87 36	.....	.....	.....	70.9	.....	.....	87	31	48	8	37	.....	4.58	0	19	12	10	.....	
Mt. Willing.....	Lowndes.....	.....	32 07	87 0	.....	.....	.....	70.5	80.8	62.6	86	22-31	46	8	49	18.2	6.65	.....	.....	.....	.....	.....	.....
Uniontown.....	Perry.....	273	32 28	86 44	29.978	30 33	8 29 72	5 72.4	80.6	62	87	31	48	8	49	18.6	3.10	13	4	11	7	W	
Citronelle.....	Mobile.....	352	31 08	87 30	.....	.....	.....	72.6	82.3	62.9	92	31	46	8	46	19.4	7.47	19	3	9	11	.....	
Fayette.....	Payette.....	.....	33 42	83 12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Luverne.....	Crenshaw.....	.....	31 45	81 40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Guntersville.....	Marshall.....	.....	34 24	86 20	.....	.....	.....	64.9	81.9	48	87	23	47	11, 14, 23	40	17	1.32	.....	.....	.....	.....	4	Se
Columbiana.....	Limestone.....	.....	34 52	86 15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Centre.....	Shelby.....	729	33 15	86 56	.....	.....	.....	68.1	80.1	56	88	31	38	8	50	14	5.06	.....	.....	.....	.....	8	.....
Double Springs.....	Cherokee.....	.....	34 10	86 30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Butler.....	Winston.....	.....	34 09	85 35	.....	.....	.....	62.9	81.6	57.9	91	31	34	8	57	23.7	7.39	19	12	0	7	Ne	
Jasper.....	Choctaw.....	.....	32 05	87 24	.....	.....	.....	71.7	82.3	61.1	87	22 & 23	44	8	943	21.2	7.40	.....	.....	.....	.....	9	.....
Chepultepec.....	Walker.....	310	33 49	88 12	.....	.....	.....	67.7	77.6	59.3	84.5	31	40 5	8	44	16.7	3.55	9	10	12	10	S	
Carrollton.....	Blount.....	.....	.....	.....	.....	.....	.....	64.9	66.6	63.9	87	65	1	8	25	2.1	.....	.....	.....	.....	.....	.....	.....
Means.....	Pickens.....	33 14	88 01	.....	29 992	.....	.....	69.7	77.7	46.3	87	31	46	8	41	13.9	5.24	.....	.....	.....	.....	.....	.....
Means.....	.....	.....	.....	.....	.....	.....	.....	69.4	79.9	46.0	87	.....	.....	.....	.....	.....	5.37	13 10	5	7.5	8	8	Se