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iica/jamaica

1981

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July, 1981

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YIELD RESPONSE OF YELLOW YAM (DIOSCOREA CAYENENSIS) AFTER DISINFESTING PLANTING MATERIAL OF PRATYLENCHUS COFFEAE [1/]

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ABSTRACT

Several noxious nematodes are associated with yams (Dioscorea spp) in Jamaica but Pratylenchus coffeae is the only one found infesting yellow yam (D. cayenensis) tubers affected by a dry rot called "burning". The dry rot appears to be associated with injury to stem and root primordia and in cases where the injury is severe germination and plant vigour are seriously impaired.

Plants growing from yellow yam heads disinfested of P. coffeae by dipping for 30 min in a 2000 ppm solution of Oxamyl or for 45 min in water at 45C produced 36% and 23% greater quantitative yields of tubers which showed lower levels of the nematode-related dry rot than tubers borne by plants arising from undisinfested heads. Results suggest that growers should use yellow yam planting material with the least evidence of the dry rot. It is recommended that an agency be established whose immediate responsibility would be to disinfest available yam planting material and eventually be responsible for providing "clean" planting material.

1/ Part of studies conducted jointly by the Plant Protection Division, Ministry of Agriculture (MINAG), Jamaica and the Inter-American Institute for Co-operation on Agriculture (IICA), at Allsides, Trelawny on the Project titled "Hillside Farming Development Project".

2/ Nematologist, Plant Protection Division, MINAG, Agricultural Research Specialist, IICA and Project Agronomist, MINAG, respectively.

P R E F A C E

Yams constitute one of the most important staples in the Jamaican diet. Yields continue to decline so that increased production is largely the result of using increased acreage. One of the main factors responsible for this situation is nematode infestation.

This paper is the first in a series which will be prepared with a view to developing corrective strategies. It provides yet another example of the joint effort between MINAG and IICA/Jamaica in identifying ways and means for redressing some of the problems confronting Jamaican agriculture.

Additionally this paper identifies another example in which simple and relatively low-cost technology can pay high dividends. I congratulate the authors on their presentation and I trust that the inherent implications for further research of an adaptive nature will be pursued and that its main recommendation will be adopted.

Percy Aitken-Soux
Director

INTRODUCTION

Yams (Dioscorea spp) have traditionally constituted the staple root crop in the Jamaican diet. The yellow yam (D. cayenensis) is the most popular variety and in 1978 constituted 33% of total yam production of 164,500 tons. Between 1970 and 1979, average tuber yield of yellow yam ranged from 10.8 to 12.8 tons/ha which is considerably below the yield potential of this cultivar.

In Jamaica, several parasitic nematodes are associated with yam plants in the field (5,6). Pratylenchus coffeae, Scutellonema bradys and Hoplolaimus sp. are involved in the etiology of a dry rot of yam tubers (2,3,4,7,8,10). P. coffeae, considered to be the most noxious of the nematodes affecting yams (7,8), is the only nematode found infesting yellow yam tubers which are affected by the dry rot, called "burning" in Jamaica. This condition is characterised by cracking in the skin underlaid by a brown, corky rot in the storage tissues (3,10). This rot progresses deeper into the yam tissues following harvest and prior to planting or consumption and is generally more pronounced towards the stem end of yam tubers. When a yellow yam tuber is harvested, the stem end ("head") is cut off and retained for planting and the remainder consumed. On heavily "burnt" heads, stem primordia appear to be damaged or destroyed by the dry rot resulting in such heads not sprouting or vines growing from them being less thrifty than those from less affected heads. The term "less affected" is used as a yellow yam tuber which was not infested by P. coffeae and affected to some extent by the dry rot has never been observed by the senior author.

When yam tubers affected by the dry rot were disinfested in previous investigations, populations of the invading nematode were reduced and development of the dry rot suppressed. There was a high incidence of sprouting and vines were more vigorous than those from untreated yams (2,3,4,6,7,8).

This trial was conducted to investigate qualitative and quantitative yield response after disinfesting yellow yam planting material of Pratylenchus coffeae.

MATERIALS AND METHODS

This trial was carried out at the Allsides Pilot Development Project (1,9,11,12,13), on recently-terraced plots which had been cropped for two successive years to yellow yam. Recently-harvested yellow yam planting material showing distinct symptoms of the nematode-related dry rot was used. Examination of random samples from the selected heads showed them to be infested with P. coffeae (avg. 400/10 gm peeling). The following treatments were used:

1. No treatment (control)
2. Heads dipped for 45 min in water at 45C
3. Heads dipped for 30 min in a 2000 ppm solution of Oxamyl (Methyl N'N'-dimethyl-N-(methylcarbamoyl)oxy)-1-thiooxamimidate).

Six days after being dipped, the heads were planted, 12 per plot, 0.67m apart into two continuous mounds 1.5m apart giving a plant density of 10,000/ha. The three treatments were replicated three times in a randomised complete block design. The soil, an Ultisol classified locally as Wire Fence Clay Loam, Map No. 32, is highly acidic (pH 4.9) and levels of available N, P and K are medium, low and very low respectively.

Cultural practices were those normally followed at Allsides. Weeds were controlled manually. Plants were supplied with a mixture of 200, 300 and 150 kg/ha of N, P_2O_5 and K_2O respectively divided equally at planting and at 16 and 25 weeks thereafter.

Forty weeks after planting, counts were made of P. coffeae in soil from each plot. At 43 weeks when the plots were harvested, every tuber was rated for the nematode-related dry rot on a 1 - 5 scale where 1 = 1-20%, 2=21=40%, 3 = 41-60%, 4 = 61-80% and 5 = 81-100% of the tuber's surface having the dry rot. The weightsof heads (the top portion of the harvested tuber which is retained for planting) and table yams (the rest of the tuber) were taken separately. Counts were made of P. coffeae in the skin of harvested tubers.

RESULTS AND DISCUSSION

There was 100% germination of heads and every plant produced a tuber. Presented in Table 1 are the tuber yields and levels of dry rot for the different treatments. Tubers borne by plants growing from heads disinfested by Oxamyl or hot water showed lower levels of the nematode-related dry rot than tubers borne by plants from untreated heads. Plants from disinfested heads produced greater quantitative yields of heads and significantly greater weights of table yams than those from untreated heads. Overall, plants from disinfested heads bore significantly greater weights of tubers than plants from undisinfested heads. Substantially higher numbers of P. coffeae were found in the skin of tubers borne by plants arising from untreated heads but three weeks before harvest, there was no difference between treatments in the numbers of this nematode in the soil from plots (Table 2).

Results from this trial confirm previous findings that disinfesting yellow yam planting material of P. coffeae, the most noxious of the nematodes affecting Dioscorea spp, will result in significantly increased tuber yields (7,8). Disinfesting heads with hot water or Oxamyl resulted in increased quantitative yields of 23% and 36% respectively. Disinfesting yam heads can be costly (estimated at over $100 per ton for Oxamyl treatment of yellow yam heads) but the high initial expenditure is easily recovered from the increased yields (estimated to result in revenue exceeding $600 from each ton of planted yellow yam heads).

Tubers borne by plants arising from disinfested heads showed less of the nematode-related dry rot than those from plants growing from untreated heads. It has been observed in an on-going trial that plants growing from yellow yam heads with low levels of the P. coffeae-related dry rot sprouted earlier and are more vigorous than plants growing from heavily dry rotted heads. It appears that levels of P. coffeae infestation and dry rotting of yellow yam heads have a direct bearing on the performance of plants arising from such heads. Any treatment that will reduce populations of an invading nematode and levels of the dry rotting of yam planting material should therefore be beneficial.

RECOMMENDATIONS

It is recommended that growers should use yellow yam planting material with the least evidence of the dry rot. However, in Jamaica, yams are always infested with noxious nematodes and those involved in the dry rot, especially P. coffeae, are ubiquitous. In any event, good yam planting material is generally unavailable and costly and growers are generally forced to plant what they have or can obtain. Given this situation, it would be beneficial to the yam industry if an agency were established to see to the disinfestation of available planting material in the first instance and eventually be responsible for providing "clean" planting material. In this context, it is hoped that the Ministry of Agriculture would take the necessary steps which would assure increased production of this staple food crop.

Table 1. Quantitative and qualitative yields of yellow yam (Dioscorea cayenensis) tubers harvested 43 weeks after planting Pratylenchus coffeae-infested planting pieces (heads) or infested heads disinfested by hot water or nematicide dips.

Treatment	Levels of dry rot on tubers[a]	Wt. of table yams harvested from 36 plants (kg)	Wt. of heads harvested from 36 plants (kg)	Total wt. of tubers harvested from 36 plants (kg)	Wt. of yams harvested per kg planted (kg)	Calculated gross yields (tons/ha)
Untreated heads	2.6	58.0	46.8	104.8	3.82	29.1
Hot water-dipped[1] heads	2.2	75.1	54.6	129.7	4.95	36.0
Oxamyl-dipped[2] heads	2.0	91.1	51.7	142.8	5.05	39.7
LSD 5%	-	2.8	-	5.2	-	-

[1]Heads dipped for 45 min. in water at 45C.

[2]Heads dipped for 30 min. in a 2000 ppm solution of Oxamyl.

[a]Tubers rated for the nematode-related dry rot on a 1 - 5 scale where 1 = 1-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61-80% and 5 = 81-100% of the tuber's surface having the dry rot.

Table 2. Numbers of Pratylenchus coffeae in soil and in the skin (peeling) of yellow yam (Dioscorea cayenensis) tubers harvested from plots in which nematode-infested planting pieces (heads) or infested heads disinfested by hot water or nematicide dips were planted.

Treatment	No. P. coffeae/ 100 cc soil at 40 weeks	No. P. coffeae/ 10 gm tuber skin at harvest (43 weeks)
Untreated heads	27	48
Hot water-dipped[1] heads	29	2
Oxamyl-dipped[2] heads	13	5

[1]Heads dipped for 45 min. in water at 45C.

[2]Heads dipped for 30 min. in a 2000 ppm solution of Oxamyl.

REFERENCES

1. Aitken-Soux, P., A.H.Wahab, I.E.Johnson and A. Sahni. 1979. IICA/Jamaica Publication No. IV-4.

2. Coates-Beckford, P.L. 1978. In: Investigations 1976. Bull. No. 66 (New Series), Min. of Agric., Jamaica. pp 52 - 59

3. Coates-Beckford, P.L. and C.W.D. Brathwaite. 1977. Nematropica 7 (2): 20 - 26.

4. Coates-Beckford, P.L., D.G.Hutton and A.G.Jones. 1978. Nematropica 8 (2): 6 - 7 (Abstr).

5. Dixon, W.B. and R. Latta. 1965. Nematological Investigations 1958 - 1961. Bull. No. 59 (New Series), Min. of Agric. and Lands, Jamaica. 35 pp.

6. Hutton, D.G. 1979. In: Investigations 1977/1978. Bull. No. 67 (New Series), Min. of Agric., Jamaica. pp 23 - 48.

7. Hutton, D.G. In: Investigations 1978/1979. Bull. No. 68 (New Series), Min. of Agric., Jamaica. In Press.

8. Hutton, D.G. In: Investigations 1979/1980. Bull. No. 69 (New Series), Min. of Agric., Jamaica. In Press.

9. IICA/Jamaica Staff. 1979. IICA/Jamaica Publication No. III-4.

10. Nwankiti, A.O. and O.B. Arene. 1978. PANS 24 (4): 486-494.

11. Wahab, A.H. 1978. In: IICA/Jamaica Publication No. III - 2, "Hillside Farming in Jamaica - Training Seminar". pp 149 - 161.

12. Wahab, A.H., P. Aitken and I.E. Johnson. 1980. Paper presented at Seminar on Rural Development held under the aegis of Iowa State University and IICA/OAS; Ames, Iowa, U.S.A. Sept. 29 - Oct. 3, 1980. IICA/Jamaica Publication No. IV - 16.

13. Wahab, A.H., P. Aitken-Soux, I.E. Johnson and H. Murray. 1980. Paper presented at Seminar on Cropping Systems, Ja. School of Agriculture, Twickenham Park, Jamaica, Dec. 4, 1980. pp 11 - 39. IICA/Jamaica Publication No. IV - 21.

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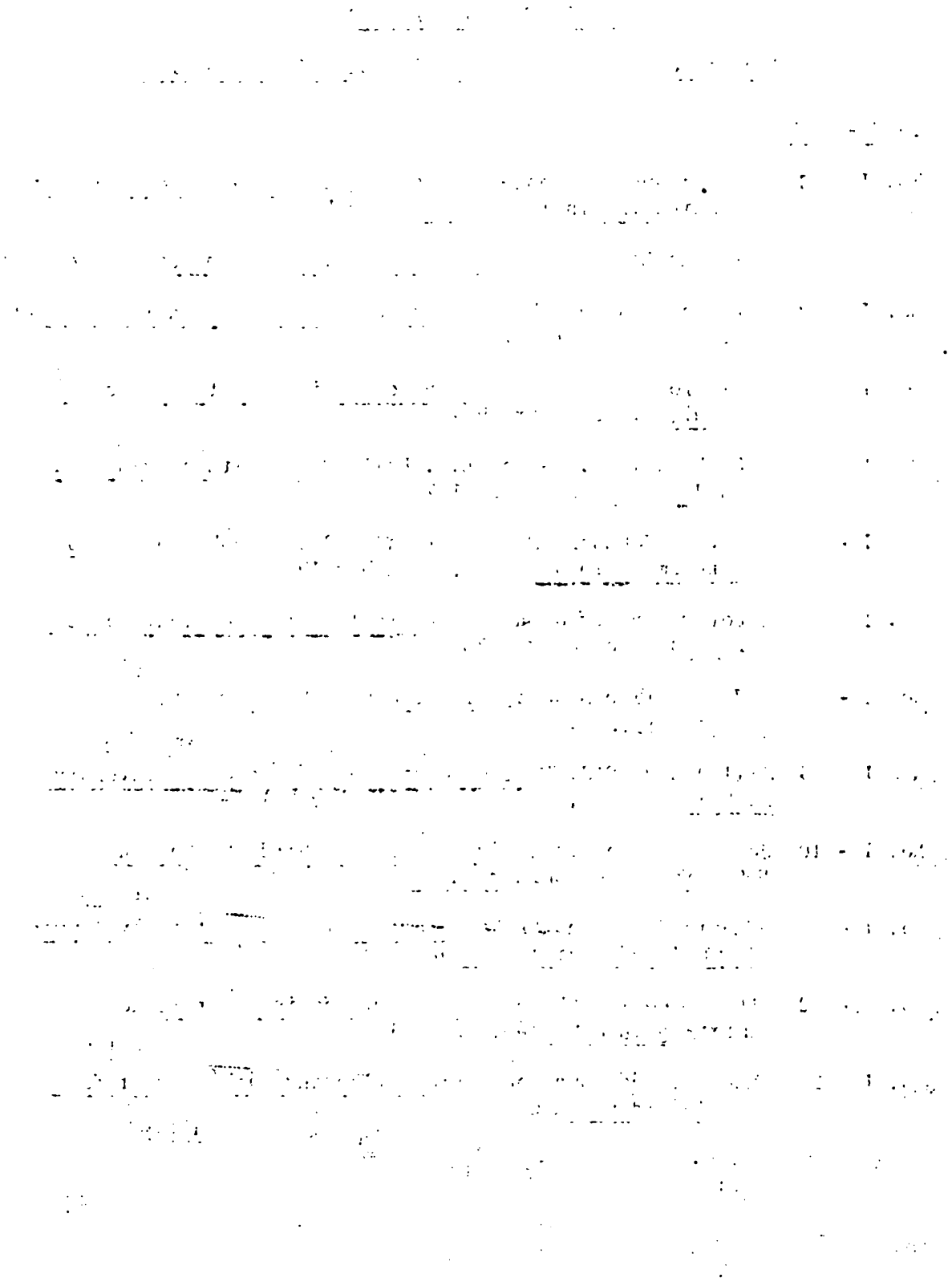

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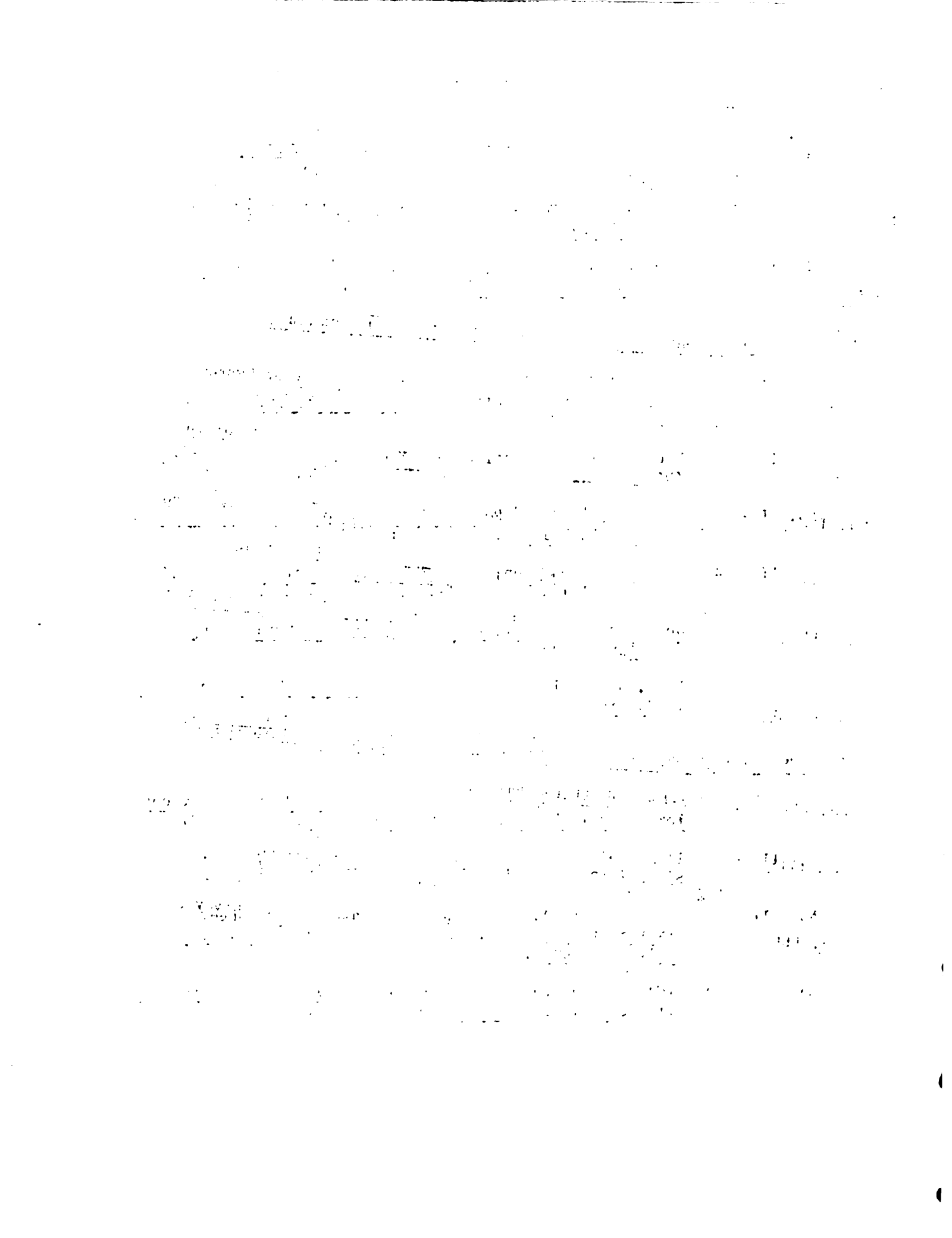

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