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EFFECT OF PRE-HARVEST FOLIAR SPRAY OF MALEIC HYDRAZIDE ON GROWTH, YIELD AND QUALITY OF POTATO*

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Single spray of maleic hydrazide (MH) made on a potato crop at 2-6 weeks before harvest at 4 concentrations (0-0 4%) had no marked influence on morphological characters. MH spray given 6 weeks before harvest at 0.2, 0.3 and 0.4 per cent reduced the total tuber yield by 5 51, 10.36 and 13.93 per cent respectively mainly by decreasing the size of tubers. The MH had no significant influence on per cent dry matter of haulm, roots and number of tubers per hill. However, it reduced the starch and total sugar content of tubers.

In potato production Maleic hydrazide (MH) is used as a sprout suppresant and being applied as a foliar spray before the harvest of the crop. The time of application is critical Early application can result in yield reduction, where as late application will render the treatment ineffective (Burton, 1978). As MH is the only chemical sprout suppresant presently permitted in the country (Sukumaran *et al.*, 1979). the present study was initiated with cv. Kufri Jyoti to study the effect of pre-harvest foliar spray of MH on growth, yield and quality of potato crop.

MATERIAL AND METHODS

A trial was carried out on the pre-harvest foliar spray of Maleic hydrazide (MH) on potato during *rabi* season of 1981-82 at the University of Agricultural sciences Gandhi Krishi Vignana Kendra campus Bangalore. A split plot design was adopted by assigning 3 times of spray viz ,6(T_1), 4 (T_2) and 2 weeks (T_3) before harvest to the main plot and four concentrations of MH viz , control (C_0) 0.2 (C_1) 0.3 (C_2) and 0.4 per cent (C_3) to the sub-plot and were replicated 4 times. The gross and net plot sizes were 4 05 m 2 8 m and 3.15m X 2.4 m respectively.

Breeders seed tubers were cut into seed pieces with 2-3 eyes and were soaked in 0.3 per cent Dithane M-45 for 10 minutes they were dried in shade and were planted at a spacing of 45 cmX 20 cm. The crop received 100 kg each of N, P and K per ha, out of which 50 percent of N was applied at planting and the rest 4 weeks later at the time

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of earthing up. The crop was raised by adopting recommended package of practices | Ten plants were selected at random from each treatment and were labelled for recording observations viz, plant height number of branches, internodal length and leaf index. At the time of spraying screens were provided on all the sides of the plot to arrest spray drift. Crop was harvested at full maturity. At harvest, dry matter of haulm and roots were calculated on ten random selected plants Total as well as grade-wise yield was recorded. The tubers were divided into three grades according to their diameter i:e, large above 51 MM, medium 25-50 mm and small below 25 mm.

RESULTS AND DISCUSSION

Pre-harvest single foliar spray of MH had no marked influence on morphological characters except number of branches which varied with different time of spray of MH and leaf index to nteraction of time and concentrations of MH applied. The non-significant response n plant height andinternodal length among :he treatments may be attributed to the :ompletion of growth in all the plants even before the treatments were imposed.

Increased number of branches due to vIH spray at 6 weeks before harvest is due to the suppression of apical lominance at lower concentrations, vhich stimulated the development of lateral branches. MH acts as an inti auxin and thus counteracts apical lominance Similar results are reported n China aster by Narayana Reddy 1977). Reduced leaf index was observed when 0 3 and 0.4 per cent MH concentration was applied at 6 weeks before harvest (T_1C_2 and T_1C_3). This is due to the inhibite leaf expension induced by MH.

Number of tubers per hill·

MH had no significant effect on tuber number per hill at harvest (Tables 2a and 2b). The number of tubers produced per hill is a function of number of main stems or shoots which is determined by the number of sprouts on seed tubers.

Dry matter of haulm and roots :

Pre-harvest single spray of MH had no marked influence on the accumulation of dry matter of haulm and roots of the plants. This can be attributed to that most of the dry matter accumulation in haulm and roots might have taken place before the treatments were imposed.

Total yield :

The total yield was significantly reduced by the time of application, the concentration and the interaction effect of them MH sprayed at 6 weeks before harvest (T_1) recorded the lowest yield (189.15 q/ha). This is due to the reduction in the yield of small and medium sized tubers (Table 3).

In respect of concentrations of MH highest reduced yield was recorded when MH was sprayed at 0.4 per cent (C_3) followed by 0.3 (C_2) and 2 per cent (C_1) which were at per, with a decreased yield of 7.68, 7.42 and 5.51 per cent respectively over the control This

reduced yield is due to the decrease in the yield of large and medium sized tubers as a consequence of hindered tuber enlargement due to the application of MH.

MH sprayed 6 weeks before harvest at 0.3 and 0.4 percent (T_1C_3 and T_1C_4) reduced the yield by 10.36 and 13.95 per cent respectively over the control (T_1C_0). MH sprayed 4 weeks before harvest at 0.3 and 0.4 per cent (T_2C_3 and T_2C_4) reduced the yield by 9.22 and 4.33 per cent respectively, whereas MH sprayed 2 weeks before harvest at 0.30 and 0.4 per cent (T_3C_3 and T_3C_4) the yield reduction was 2.83 and 4.21 per cent respectively. The reduction in total yield is mainly due to the reduced yield of large sized tubers. Similar results have been reported by many earlier workers (Rao and Wittwer 1955; Sukumaran *et al.*, 1979; and Kaul *et al.*, 1981).

Grade-wise yield :

Significant reduction in the yield of large sized tubers were observed for varying concentrations due to the interaction of time of spray concentrations (Table 3). MH sprayed 6 weeks before harvest at 0.4 per cent (T_1C_1) reduced the yield by 46.4 per cent over the control (T_1C_0). Whereas MH at 0.2 and 0.3 per cent (T_1C_1 and T_1C_2) were at par and reduced the yield by 29.45 and 29.95 per cent respectively. This reduced yield is due to hindered tuber enlargement induced by MH residue and it is well known fact that MH brings about growth retardation by bringing down the cell division to the minimum due to reduced mitotic activity (Rakitin *et al.*, 1974). Similar reduced yield due to MH is reported by Rao and Wittwer (1955). MH at varying concentrations applied at 4 and 2 weeks before harvest reduced the yield of large sized tubers but the differences among them being non-significant.

Yield of medium sized tubers was significantly reduced by spray of MH at 6 and 4 weeks before harvest (T_1 and T_2). While the concentrations, the interaction of time of spray and concentrations had no significant effect on medium sized tubers.

Time of MH spray, interaction of time of spray and concentrations had no marked influence on the yield of small sized tubers. However, the concentrations of MH at 0.3 and 0.2 per cent increased the yield significantly. This increase is due to reduced enlargement of tubers

Dry matter of tubers :

Significant differences were not evident amongst the treatments in the production of dry matter content of tubers at the time of harvest to varying concentrations, their time of application and interaction of them (Tables 2a and 2b).

Starch content of tubers :

At harvest, starch content did not vary significantly to the time of MH spray, but significant differences were observed in respect of concentrations and the interaction of time of spray end concentrations of MH (Tables 2a and

2b). Highest starch content (77.33%) was observed in the control (C_1) followed by spray of 0.2 per cent MH (C_2) which were at par. MH at 0.3 and 0.4 per cent (C_3 and C_4) had significantly lower starch content than 0.2 per cent MH or control (C_2 or C_0). Amongst the interaction, lowest (72.25%) was in the 0.3 per cent MH sbrayed at 6 weeks (T_1C_3) while highest (78.50%) was in the control (T_1C_0).

Reducing sugar :

Lower reducing sugar was observed to the spray of MH at 6 weeks (0.46%) compared to the spray at 4 and 2 weeks before harvest (0.50 and 0.52% respectively). Reducing sugar decreased with the increase in the concentrations of MH (Table 2a). Amongst interaction, the lowest (0.33%) was in the spray of 0.4 per cent MH sprayed at 6 weeks before harvest ($T_1 C_3$), while it was highest (0.54%) in the control ($T_1 C_0$). The lower reducing sugar is probably due to higher residue of MH in the tubers which might have inhibited the formation and and accumulation of reducing sugars.

Sucrose (non-reducing sugars) :

Marked differences were observed to varying concentrations, the interaction of time of spray and concentrations of MH. Amongst the interaction highest (0.86%) was in the spray of 0.3 per cent MH sprayed at 2 weeks before harvest ($T_3 C_3$). Lowest (0.68%) was in the 0.4% MH sprayed at 6 weeks harvest ($T_1 C_4$).

Total Sugar :

Different concentrations of MH significantly reduced the total sugar. Highest (1.34%)w as in the control (C_0), while lowest (1 15%) was in the 0.4% MH (C_3) MH sprayed at 6 weeks before harvest resulted in the lower total sugar of tubers and the reduction was in proportion to the concentrations of MH (Table 2b). MH at 0.2 and 0.4 per cent sprayed at 4 weeks before harvesr ($T_2 C_2$ and $T_3 C_3$) resulted in the low total sugar content of tubers. This reduction is mainely due to lower reducing sugar and sucrose content of tubers.

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Table 1 Plant characters of potato 15 days after the different times of spray and concentrations of MH

Treatments	Plant height (cm)	Number of branches	Internodal length (cm)	Leaf index
		Time of spray		
T_1	27.3	13 3	2.8	61.44
T_2	27.8	12 8	2 9	60.1
T_3	27.4	12.1	2.9	61.6
C.D. (0 05)	N.S.	0.3	N S.	N.S.
C.V. (%)	14.4	8.2	9 9	4 98
		Concentrations		
C_0	28 1	12 8	3 0	60 6
C_1	28.2	13.0	2 8	60.0
C_2	26.7	12 7	2 8	62.3
C_3	26 0	12.4	2 8	61.2
C.D. (0.05)	N.S.	N.S.	N.S.	N S.
C.V. (%)	8.4	8.2	7.6	5.4
		Time of spray x Concentrations		
T_1C_0	29.2	13.7	2 8	61.0
T_1C_1	26 0	13.2	2 8	61.0
T_1C_2	27 9	13 3	2.5	58.7
T_1C_3	26 2	13.1	2.7	56 2
T_2C_0	26.9	12.4	3 0	60.0
T_2C_1	30.7	13.5	2.8	62.5
T_2C_2	26 7	12.6	2 8	62 5
T_2C_3	27 0	12.5	2.8	63 7
T_3C_0	28 3	12 3	3 0	64.7
T_3C_1	28.0	12.4	2.9	61.0
T_3C_2	25 8	12.2	2 8	60.7
T_3C_3	26.7	11 5	2.9	60.0
C.D.[1] (0.05)	N.S.	N.S.	N.S.	4.8
C.D.[2] (0.05)	N.S.	N.S.	N.S.	4.8

C.D [1] — For comparing two MH concentration means at a fixed level of time of spray

C D.[2] — For comparing two time of spray means for a fixed or at different levels of MH concentrations.

N.S. — Non-significant

Table 2a Effect of pre-harvest foliar spray of varying levels of MH and its time of application on yield attributes and quality of tubers at harvest.

Treatments	Number of tubers per hill	Dry matter of haulm (%)	Dry matter of roots (%)	Dry matter of tubers* (%)	Starch content of tuber* (%)	Reducing sugar content of tubers %	Sucrose content of tuber* (%)	Total content of tubers* %
			Time of spray					
T_1	8.66	20.6	21.3	19.8	75.7	0 48	0.75	1.21
T_2	9.84	18.9	21.1	19 3	76.2	0.50	0.74	1 24
T_3	10.18	23.0	21.3	19.1	75.3	0 52	0 78	1.30
C.D. (P=0.05)	N.S.	N.S.	N.S	N S	N.S.	0.02	N S.	N.S'
C.V. (%)	17.66	19.2	20.1	6 4	1.7	4.70	11.66	6.04
			Concentrations					
C_0	10.28	19 8	21.2	19.3	77.3	0.55	0.79	1.34
C_1	9 68	20 5	21 6	19.3	75.6	0.48	0.74	1.22
C_3	9 59	22.5	21.4	19.8	74.0	0.47	0.80	1.27
C_2	9 42	20.6	20.7	19.3	74.7	0.48	0.69	1.15
C D. (P=0 05)	N.S.	N.S	N.S.	N.S.	1.2	0.02	0 05	0.05
C.V. (%)	28 69	21.1	21.2	6.7	2.1	4.89	6.62	4.40

* Dry weight basis
N.S. Non-significant.

Table 2b: Effect of pre-harvest foliar spray of varying levels of MH and its time application on yield attributes and quality of potato tubers at harvest

Treatments	Number of tubers per hill	Dry matter of haulm%	Dry matter of roots%	Dry matter of tuber* %	Starch content of tuber* %	Reducting sugar content of tuber*%	Sucrose content of tuber* %	Total sugar content of tuber* %
			Time of spray X Concentrations					
T_1C_0	9.3	19.1	20.8	20.5	78.5	0.54	0 81	1.35
T_1C_1	8.1	22.3	22.1	19.7	75.7	0.47	0.77	1 24
T_1C_2	9.5	19.8	22.8	20.6	72.2	0 45	0.73	1.18
T_1T_3	9.2	21 3	19.5	18.9	76.5	0.33	0.68	1.07
T_2C_0	8.6	18.3	22 1	18.9	76.7	0.54	0.72	1.26
T_2C_1	8 9	18.1	22.7	18.6	76.7	0.49	0.71	1.20
T_2C_3	10.8	21.7	20.1	18 9	74.0	0.48	0.85	1.31
T_2C_2	9 5	17.6	19 5	19.8	73.5	0.51	0.69	1.20
T_3C_0	12.6	22 0	20.6	18.7	76 7	0.58	0.84	1.42
T_3C_1	10.2	21.1	18.9	19.5	74.5	0.48	0.74	1.22
T_3C_3	8.4	26 0	21.3	19 0	75 7	0.52	0 88	1.38
T_3C_2	9 4	22.8	23.2	19.5	74.2	0 50	0.71	1.21
C.D.[1] (P=0.05)	N.S.	N S.	N.S.	N.S	2 35	0.04	0.08	0.08
C.D.[2]. (P=0.05)	N.S.	N.S.	N.S.	N.S.	2.32	0.04	0.11	0.09

C.D[1].—For comparing two MH concentration means at a fixed level of time of spray.
C D.[2]—For comparing two time of spray means for a fixed or at different levels of MH concentrations.
*—Dry weight basis
N S—Non-Significant.

Table 3 Effect of pre-harvest foliar spray of varying levels of MH and its time of application on gradewise and total yield of potato

Treatments	Yield per hectare (q)				Per cent reduced total yield over control
	Large	Medium	Small	Total	
			Time of spray		
T_1	88.4	95.9	4.7	189.1	—
T_2	91.5	98.8	6.8	197.2	—
T_3	86.1	115.4	5.9	207.4	—
C.D. (0.05)	NS	9.7	NS	4.4	—
C.V. (%)	15.7	10.8	42.1	2.5	—
			Concentrations		
C_0	101.6	101.4	5.1	208.2	—
C_1	83.7	107.5	6.9	198.2	5.6
C_2	82.1	98.5	7.0	192.7	7.4
C_3	87.1	106.1	4.3	192.5	7.6
C.D. (0.05)	12.4	NS	1.8	5.4	—
C.V. (%)	16.6	13.8	38.1	14.9	—
			Time of spray x Concentrations		
T_1C_0	119.0	80.6	4.6	204.3	—
T_1C_1	83.9	102.1	6.9	193.1	6.5
T_1C_2	86.9	92.2	3.9	183.2	10.3
T_1C_3	63.8	108.7	3.3	175.9	13.9
T_2C_0	109.2	103.1	4.6	208.0	—
T_2C_1	79.6	105.1	8.2	193.1	7.1
T_2C_2	86.6	92.9	9.2	188.8	9.2
T_2C_3	99.5	94.2	5.2	199.0	4.3
T_3C_0	85.6	120.3	6.1	212.3	—
T_3C_1	87.6	115.4	5.6	208.6	1.7
T_3C_2	87.9	110.4	7.9	206.3	2.8
T_3C_3	83.0	115.4	4.9	203.4	1.2
C.D.[1] (0.05)	21.48	NS	NS	9.38	—
C.D.[2] (0.05)	22.06	NS	NS	9.15	—

C.D.[1] — For comparing two MH concentrations means at fixed level of time of spray.

C.D.[2] — For comparing two time of spray means for a fixed or at different levels of MH concentration.

NS-Non-Significant