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OPTIMUM SPRAY VOLUME REQUIREMENTS FOR RICE AT DIFFERENT STAGES OF GROWTH

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Precise information on the optimum spray volume required for treating rice crop at different growth stages is lacking. Patel (1960) recommended 40-80 gallons of spray fluid for 1 ha of paddy under high volume application. For brown plant hopper control, 333, 500 and 1000 litres of spray fluid per ha were found as optimum at 15, 35 and 60 days after transplanting. (Aquino and Heinrichs, 1978). The relation between volume of spray fluid required and leaf area index of the crop was emphasised by earlier workers (Potts, 1946; Courshee, 1960; Mathews, 1971). But leaf area index of rice was not considered in any of the previous investigations for estimating the volume of spray fluid required. In this context, investigations were carried out to assess optimum volumes of insecticide suspension required to give highest level of deposit on the leaves of rice at different growth stages of the crop and to correlate the optimum volumes with leaf area indices of the crop at respective stages. This was done for low and high volume spraying.

Materials and Methods

Two field experiments were conducted at the College of Agriculture, Vellayani during the second and third crop seasons (variety Jyothi) of 1980–81 adopting a randomised block design and each treatment was replicated thrice. The plots (8 x 5 m) were separated from each other by 0,5 m wide bunds and 1 m wide buffer area. Carbaryl 50 WP (supplied by M/s. Union Carbide India Ltd) was suspended in water at 0.2% concentration and different volumes of this spray fluid were applied using a pneumatic knapsack sprayer in the first experiment. All these treatments were tried at four different growth stages of the crop (30, 45, 60 and 75 days after sowing) and none of the plots was sprayed more than once. In the second experiment the same number of treatment combinations, but different volumes (60, 90, 120, 150, 180, 210, 240, 270, 300, 330 and 360 l/ha) of 0.2% carbaryl suspension were applied using a power operated mist blower (Star Mist). The sprayers were calibrated and the effective swath widths were standardised in such a way that the varying quantities of spray fluid to be applied in each plot could be sprayed in a single round.

The level of pesticide deposit retained on leaves of rice collected after spraying was taken as an index of bioefficacy. Plant samples were collected at random two hours after spraying and the carbaryl deposit on ten g of leaves was

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extracted and estimated colorimetrically using the chemical assay method of Benson and Finochiare (1965). Three samples were collected from each plot.

The leaf area index at each stage of growth was also estimated adopting the method suggested by Gomez (1972). The variance between mean deposit on rice leaves, sprayed with different volumes of carbaryl suspension was tested for significance at each stage of growth and the minimum volume giving the highest deposit on leaves was selected as the optimum volume for that particular stage. The optimum volumes thus obtained for each stage of growth was correlated with leaf area index of the respective stage, and statistical models were fitted for both the type of sprayers.

Results and Discussion

The data relating to the first and second experiments are presented in Tables 1 and 2 respectively. When the insecticide suspension was applied with a pneumatic knapsack sprayer at 30 DAS (days after sowing) the extent of deposit indicated that optimum coverage of the leaf surface was obtained at 200 I/ha beyond which the increase in volume of spray fluid did not cause any increase in the deposit, probably due to the onset of run–off loss. At 45 days after sowing, the optimum level of spray requirement with pneumatic sprayer was 350 I/ha which was statistically on par with the deposit obtained in plots treated at 300 I na and the latter was chosen as the optimum effective rate for that particular stage. Similarly, at 60 and 75 days after sowing, a spray volume of 500 I/ha was the lowest volume which gave deposits at levels significantly higher than those of other treatments.

The leaf area indices of the crop at the above four stages were 0.58, 1.63, 1.97 and 2.04 respectively and the optimum volumes chosen were 200, 300, 500 and 500 I/ha, Correlation between these two variables (r = 0.93) was significant at 0.05 level and the regression equation for optimum volume of spray in term? of leaf area index was $y = 58.57 + 203.49\ x$ where y = volume of spray fluid and x is leaf area index.

In the second experiment, the crop was sprayed with a mist blower at different levels of insecticide suspensions keeping the concentration of carbaryl at *0.2%* itself. At 30 DAS the highest insecticide deposit was observed in plots treated with the suspension at 90 I/ha and the deposits formed at all the higher volumes were lower than or on par with the treatment. This indicated the possible commencement of run-off above th3 level of 90 I/ha. At 45 DAS the optimum level of spray volume was obtained at 120 I/ha. At 60 and 75 DAS the minimum volume requiredfor obtaining a deposit significantly higher than in other treatments was found to be 180 I/ha.

Table 1

Deposit of carbaryl on leaves of rice sprayed with different volumes of the insecticide suspensions at different growth stages of the crop, using a pneumatic knapsack sprayer

Volume of suspension sprayed (l/ha)	Dosage kg ai/ha	Mean deposit (ppm) on plants treated at			
		30 DAS	45 DAS	60 DAS	75 DAS
100	0.2	4.86	3.16	1.17	1.89
150	0.3	5.72	3.51	2.23	4.39
200	0,4	7.77*	5.24	3.16	5.05
250	0.5	7.14	6.03	3.68	8.97
300	0.6	5,93	9.20*	4.21	12.51
350	0.7	5.83	10.17	4.90	17.91
400	0.8	5.73	8,97	8.63	19,88
450	0.9	6.06	9.20	9.79	20,04
500	1.0	5.98	9.32	13.19*	24.36*
550	1.1	6.08	8.97	11.47	25.74
600	1.2	5.40	8.55	10.37	23.43
CD (0,01)	—	1.31	1.54	1.32	2.09

DAS - Days after sowing

Recovery of pesticide from fortified leaf samples: 90.86—96.45%

* Deposit corresponding to optimum volumes (minimum volume giving highest deposit at) each stage

The leaf area indices of crop in the second experiment at the above four stages were 0.63, 1.58, 2,24 and 2.31 respectively and the corresponding optimum volumes chosen for mist blower were 90, 120, 180 and 180 l ha. The correlation coefficient (r = 0.97) was significant at 0.05 level and the regression equation derived was $y = 47.92 + 55.96 x$.

From the two regression equations derived for two type of sprayers, it may be seen that for every increase of leaf area index of rice to the extent of 0.1, an approximate enhancement of the spray volume by 20 litre may have to be made when a pneumatic knapsack sprayer is used or an enhancement of 11 litres may have to be made when a mist blower is used. Similar estimation of the volume of spray fluid required for unit increase in height of cotton crop has been worked out earlier {Tunstall *et af,,* 1961).

Summary

Field experiments were conducted for two seasons in 1980–'81 at the College of Agriculture, Vellayani for assessing the optimum volumes of insecticide suspension required for treating rice crop at different growth stages of the crop using a

Table 2

Deposit of carbaryl on leaves of rice sprayed with different volumes of the insecticide suspension at different growth stages of the crop, using a mist blower

Volume of suspension sprayed (l/ha)	Dosage kg ai/ha	Mean deposit (ppm) on plants treated at			
		30 DAS	45 DAS	60 DAS	75 DAS
60	0.12	6.82	5.73	4,39	4.66
90	0.18	8.85*	8.53	6.03	7.55
120	0.24	8.53	10.50*	7.55	9.44
150	0.30	7.33	10.13	9.89	11.47
180	0.36	8.09	10.01	14.15*	15.84*
210	0.42	8.29	9.81	13.19	15 65
240	0.48	7.79	9.56	13.07	15.03
270	0.54	7.97	9 30	12.78	14.74
300	0.60	8.31	10.13	12.43	13.59
330	0,66	7.89	9.44	12.98	14.03
360	0.72	6.94	9.21	12.58	13.05
CD (0.01)	—	1.14	1.64	1.72	1.72

DAS — Days after sowing

Recovery of pesticide from fortified leaf sample: 90.86 to 96.45%

* Deposit corresponding to optimum volume selected at each stage

pneumatic knapsack sprayer and mist blower. The results showed that the optimum volumes of 0.2% carbaryl suspension required to give highest deposits on leaves were 200, 300, 500 and 500 l/ha in the case of a pneumatic knapsack sprayer and 90, 120, 180 and 180 l/ha in the case of a mist blower at 30, 45, 60 and 75 days after sowing respectively. The optimum volumes thus obtained were correlated with the leaf area indices of the respective stages of growth and relevant statistical models were fitted for both the type of sprayers.

സംഗ്രഹം

നെല്ലിന്റെ വളർച്ചയുടെ വിവിധ ദശകളിൽ തളിയ്ക്കുന്നതിന് അനുയോജ്യമായ ദ്രാവകത്തിന്റെ അളവ് തിട്ടപ്പെടുത്തുവാൻ വെള്ളായണി കാർഷിക കോളേജിൽ നടത്തിയ പരീക്ഷണങ്ങളിൽ നിന്നും 30, 45, 60, 75 ദിവസം മൂപ്പെത്തിയ നെല്ലിന് കുറഞ്ഞപ്രമുപയോഗിയ്ക്കുമ്പോൾ ഹെക്ടറൊന്നിന് യഥാക്രമം 200, 00, 500, 500 ലിറ്ററും പവർ സ്പ്രേയറുപയോഗിയ്ക്കുമ്പോൾ യഥാക്രമം 90, 120. 180, 180 ലിറ്ററും ആവശ്യമാണെന്ന് കണ്ടു.

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