



## Effect of mutagens on induced variability in eggplant (*Solanum melongena*)

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Eggplant (*Solanum melongena* L.) fruits are rich source of minerals like calcium, magnesium, potassium, iron, zinc and copper. It is a fair source of fatty acids and is used for medicinal purposes in curing diabetes, asthma, cholera, bronchitis and diarrhoea. Leaf and fruit, fresh or dry produce marked drop in blood cholesterol level. The de-cholesterolizing action is due to high concentration (65.1%) of polyunsaturated fatty acids (lignoleic and linolenic) present in flesh and seeds. The presence of magnesium and potassium salts also help in decholesterolizing action. Aqueous extract of fruit inhibits choline esterase activity of human plasma. Dry fruit is reported to contain goitrogenic principles.

Mutation breeding is important from theoretical and applied points of view and is one of the most effective tools for creating genetic variability (Khan and Goyal 2009). Cultivars have been developed through mutation breeding coupled with crossing in eggplant. Yet many specific character improvement like resistance to bacterial wilt, drought tolerance, etc. calls for adoption of induced mutation breeding program. In mutagenesis, the choice of the mutagen is most important.

Even though, mutation breeding, a powerful tool for inducing variability has been attempted in many crops, only very meagre reports were available in eggplant. In view of the above facts, the present investigation was undertaken to identify the most effective and efficient mutagen among the gamma rays, DES and EMS on the magnitude of induced genetic variability in M<sub>2</sub> and M<sub>3</sub> generations.

The present study was conducted during 2007–2010 at Plant Breeding Farm, Faculty of Agriculture, Annamalai University, Chidambaram for creation of variability and to workout effectiveness and efficiency of mutagens in eggplant. Healthy and pure seeds of five eggplant cultivars, viz. Angoor,

Annamalai, Hissar Pragath, PLR 1 And Putheri were treated with physical mutagen, viz. gamma rays and two chemical mutagens, viz. Ethyl Methane Sulphonate (EMS) and Diethyl Sulphate (DES) for inducing mutation on seven quantitative characters, viz. days to 50% flowering, plant height, number of branches per plant, number of fruits per plant, fruit length, fruit weight and fruit yield per plant. Healthy and dried seeds were treated at the Gamma Chamber, Kidway Institute of Cancer Research, Bangalore.

The treated seeds were placed in the moist germination paper as per the standard method of seed testing and rolled separately for each treatment including control with three replications.

The bulked seeds from individual treatments of M<sub>1</sub> generation were used for raising the M<sub>2</sub> generation. The M<sub>2</sub> generation was grown with three replications in randomized block design. The number of plants per treatment was fifty and was transplanted to experimental plots of 3 m × 4.5 m. The M<sub>2</sub> generation was critically screened for chlorophyll mutations and mutation frequency was determined. All the recommended cultural operations namely weeding, protective irrigations and plant protection measures were carried out during the crop growth.

Genotype wise and treatment wise seeds from three replications in M<sub>2</sub> generation were mixed for advancing to M<sub>3</sub> as bulk families. One hundred plants were raised per treatment per genotype. For estimation of induced variability, five plants were randomly selected from each treatment in M<sub>2</sub> and M<sub>3</sub> generation and mean values and coefficient of variation were calculated using standard statistical procedures.

The usefulness of a mutagen in mutation breeding not only depends on its mutagenic effectiveness (mutation per unit dose of mutagen), but also on its mutagenic efficiency (mutation in relation to undesirable changes or damages like sterility, lethality, injury etc.). The higher efficiency of a mutagen indicates relatively less biological damage in relation to mutations induced (Goyal *et al.* 2009; Jain and Khandelwal, 2009 and Pavadai *et al.* 2009). The selections of effective and efficient mutagens are very essential to recover a high

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Table 1 Mean and coefficient of variation of yield and yield components in M<sub>2</sub> generation in eggplant cultivars treated with mutagens

Genotype	Treatment (Dose/conc.)	Days to 50% flowering		Plant height		Number of branches/Plant		Number of fruits/plant		Fruit length		Fruit weight		Fruit yield/ Plant	
		Mean	CV (%)	Mean (cm)	CV (%)	Mean	CV (%)	Mean	CV (%)	Mean (cm)	CV (%)	Mean (g)	CV (%)	Mean (g)	CV (%)
Angoor	Control	69.26	7.25	91.23	12.35	4.97	10.52	11.31	14.16	9.07	10.65	62.09	6.39	584.66	19.89
	10 krad Gamma rays	72.53	7.51	84.99	11.02	7.94	13.29	11.55	22.40	10.56	16.18	79.95	8.87	621.74	23.84
	0.04% DES	70.11	8.06	75.47	15.04	6.63	12.09	10.82	27.19	9.90	17.52	47.08	12.55	596.65	28.38
	0.6% EMS	76.07	10.45	58.94	16.50	3.98	12.42	8.15	29.64	9.36	14.56	54.09	10.23	608.35	21.47
Annamalai	Control	69.13	7.23	86.81	11.56	6.11	13.25	17.58	11.62	11.61	18.13	61.17	14.67	1248.55	18.68
	10 krad Gamma rays	64.56	7.73	54.42	10.42	7.73	13.84	15.22	15.27	10.08	14.81	76.12	9.36	1441.11	18.25
	0.04% DES	68.78	9.15	78.14	11.04	7.50	12.68	7.63	18.82	9.74	17.83	51.64	10.07	1212.85	23.91
	0.6 per cent EMS	70.48	11.18	72.06	13.84	5.88	10.26	10.81	17.71	8.69	15.75	75.10	12.39	1402.06	18.90
Hissar Pragath	Control	71.72	8.12	84.10	12.52	10.57	16.25	20.45	20.41	10.88	12.45	77.64	10.07	1286.74	20.94
	10 krad Gamma rays	63.71	9.34	58.26	10.90	9.23	12.59	11.30	14.51	6.55	10.56	70.10	8.75	1341.76	20.65
	0.04% DES	69.55	10.66	77.36	12.10	8.12	10.38	10.44	20.21	6.79	17.62	70.49	13.23	1238.82	22.12
	0.6% EMS	77.96	12.44	65.74	15.21	9.05	14.27	12.90	19.35	8.34	15.65	85.16	15.85	1411.55	26.68
PLR 1	Control	79.61	9.58	83.39	11.70	7.11	10.58	12.96	12.56	5.32	15.11	58.16	13.39	1236.36	19.44
	10 krad Gamma rays	73.40	12.56	72.07	9.31	12.31	14.25	9.16	14.56	10.00	12.86	79.27	11.29	1212.75	19.56
	0.04% DES	68.76	10.85	78.64	12.58	9.02	11.26	6.89	23.55	10.39	15.11	51.73	11.69	858.58	21.44
	0.6% EMS	84.76	9.67	85.18	13.68	6.18	13.69	10.37	17.63	9.96	10.06	62.45	13.23	1322.50	21.03
Putheri	Control	88.30	10.98	85.62	10.38	6.96	10.96	15.20	18.82	9.60	12.62	52.93	6.44	1240.13	17.31
	10 krad Gamma rays	79.63	8.85	78.53	11.14	8.25	15.10	8.03	17.71	10.93	13.46	55.03	8.26	1208.33	22.65
	0.04% DES	75.42	9.21	86.83	16.25	10.42	15.81	11.16	20.41	7.86	12.39	42.28	12.62	1216.40	21.66
	0.6% EMS	80.69	10.65	74.37	11.84	7.26	12.67	10.05	19.36	6.19	13.39	59.91	10.56	1308.21	20.83
	S Ed	0.39		1.72		0.13		0.33		0.08		0.08		0.08	
	CD (P=0.05)	0.67		3.25		0.27		0.76		0.16		0.18		0.18	

Table 2 Mean and coefficient of variation of yield and yield components in M<sub>3</sub> generation in eggplant cultivars treated with mutagens

Genotype	Treatment (Dose/conc.)	Days to 50% flowering		Plant height		Number of branches/Plant		Number of fruits/plant		Fruit length		Fruit weight		Fruit yield/ Plant	
		Mean	CV (%)	Mean (cm)	CV (%)	Mean	CV (%)	Mean	CV (%)	Mean (cm)	CV (%)	Mean (g)	CV (%)	Mean (g)	CV (%)
Angoor	Control	70.03	7.98	89.50	10.70	4.93	13.89	15.76	17.44	9.02	10.64	63.47	8.61	595.30	17.90
	10 krad Gamma rays	73.26	9.11	75.82	9.32	4.84	10.76	12.34	12.40	13.19	9.03	62.74	7.48	609.22	17.65
	0.04% DES	70.34	10.63	76.47	10.34	4.22	12.20	11.53	17.27	9.68	15.06	56.86	11.31	628.97	18.91
Annamalai	0.6% EMS	76.25	6.18	88.73	13.00	4.99	8.87	9.24	16.54	10.26	13.38	54.98	13.55	603.96	22.80
	Control	69.33	6.61	90.01	9.88	6.58	11.32	19.87	9.93	11.28	15.50	63.26	12.54	1357.37	15.97
	10 krad Gamma rays	66.53	7.82	78.11	8.91	7.20	11.83	21.15	13.05	14.89	12.66	76.55	8.00	1444.71	20.44
Hissar Pragath	0.04% DES	70.35	9.56	69.85	9.44	5.94	8.77	15.74	16.09	10.85	15.24	51.82	8.61	1216.35	15.60
	0.6% EMS	71.09	10.68	81.39	11.83	6.61	10.84	19.88	15.14	13.15	13.46	65.41	10.59	1410.93	16.15
	Control	72.11	7.56	95.51	8.87	10.99	9.37	20.19	16.09	12.31	10.79	79.72	5.50	1211.05	14.79
PLR 1	10 krad Gamma rays	66.01	7.87	72.35	9.52	9.49	12.91	13.39	15.14	14.49	11.50	72.18	7.06	1327.94	17.80
	0.04% DES	71.30	9.10	60.11	13.89	8.17	13.51	11.72	17.44	13.68	10.59	71.45	9.03	1044.22	18.51
	0.6% EMS	78.36	6.20	57.13	10.12	10.45	10.83	21.18	16.55	16.87	11.44	92.22	10.79	1440.27	19.36
Putheri	Control	81.70	6.42	86.84	10.56	7.21	8.99	13.71	12.10	5.58	9.10	59.86	5.46	1256.81	17.00
	10 krad Gamma rays	72.54	6.89	71.33	9.42	7.88	11.36	12.46	19.15	13.52	13.83	61.09	7.58	1205.48	20.38
	0.04% DES	68.56	8.93	87.31	12.85	6.38	10.62	11.27	23.24	10.63	14.97	50.22	8.74	845.46	24.26
Putheri	0.6% EMS	84.81	7.98	82.18	14.10	8.82	10.33	12.73	25.33	16.79	12.44	62.82	10.73	1257.53	18.35
	Control	87.07	9.11	84.14	10.00	6.86	9.04	15.45	10.74	8.46	12.91	52.07	11.44	1219.26	16.62
	10 krad Gamma rays	78.91	10.63	77.77	7.96	7.08	12.18	16.04	12.44	11.83	10.99	54.55	9.65	1385.93	16.72
Putheri	0.04% DES	74.30	6.18	84.39	10.75	7.00	9.62	12.14	20.13	13.85	12.91	53.85	9.99	1270.85	18.32
	0.6% EMS	80.66	6.61	81.86	11.69	7.46	11.70	11.08	15.07	6.51	8.60	41.57	11.31	1298.04	17.97
	SEd	0.17		0.22		0.09		0.11		0.49		0.07		0.47	
CD (P=0.05)	0.32		0.55		0.18		0.23		0.98		0.14		0.924		

frequency and spectrum of desirable mutations (Mahla *et al.* 2010; Sonu Goyal and Samiullah 2010; Thilagavathi and Mullainathan 2009; Ganapathy *et al.* 2008).

In the  $M_2$  generation, the mean values and coefficient of variation were calculated for yield and yield components (Table 1). The coefficient of variation for all the quantitative characters were of higher magnitude when compared to control in all the five cultivars treated with either gamma rays or Ethyl Methane Sulphonate (EMS) or Diethyl Sulphate (DES) which shows induction of variability for these traits. The variability in quantitative characters increased considerably with the treatment of biological materials with different mutagenic agents. In crops like eggplant where the variability in the base population is not very high, this approach helps to generate new variability. Among different methods available to detect the induced variability in the mutated population, mean and components of variance serve as suitable parameters. It is also believed that more reliable and confirmatory results could be obtained in advanced generations beyond  $M_2$  generation. However an estimation of the extent of variability induced in  $M_2$  generation will be of great value to provide useful information for carrying out further selection.

In the present investigation, the mean of the treatments shifted to both positive and as well as negative side from the mean of the untreated control for the different characters (Pavadai *et al.* 2010). The mean values showed a positive shift for the characters such as number of branches per plant (10 krad gamma rays and 0.04% DES), fruit length (10 krad gamma rays), fruit girth (10 krad gamma rays) and fruit weight (10 krad gamma rays). Whereas, negative shift was noted in the characters plant height and fruits per plant in both the  $M_2$  and  $M_3$  generations (Tables 1 and 2). The increase or decrease on the proportion of genes with positive or negative effects would have caused the shift in the mean of the treated genotypes in the present observation.

An increase in genetic variability might be due to the occurrence of extreme types, both on the positive and negative side of the control and the means of the treated progenies were almost comparable with the control means. This is due to the fact that the effect of mutagens on the quantitative traits has been interpreted as that owing to detrimental mutations which are supposed to occur more frequently than favourable ones. It was also noted that the increased genetic variation permitted effective selection response in each direction even in characters approaching the limits within the species.

## SUMMARY

Gamma rays, Ethyl Methane Sulphonate (EMS), diethyl sulphate (DES) were employed and  $M_1$ ,  $M_2$  and  $M_3$  generations were studied for the characters, viz. days to 50% flowering, plant height, number of branches, fruits per plant, fruit length, fruit girth, fruit weight and fruit yield per plant. A significant reduction in seed germination, shoot length and RL were observed with increase in concentration of mutagens. Among the mutagens gamma rays were found to bring more reduction for all the major traits studied. The mean performance showed significant increase in the number of branches, fruits per plant, fruit length and fruit yield per plant in  $M_2$  and  $M_3$  generations. Whereas, days to 50 per cent flowering and plant height showed a slight deviation from the control in the treated populations.

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## CORRIGENDUM

In article Impact of technology and policy on growth and instability of agricultural production: The case of cotton in India by A Sureh *et al.* published in *The Indian Journal of Agricultural Sciences* 83(8): 939–48, September 2013 the name of the fourth author may be read as Shwetal Wankhede



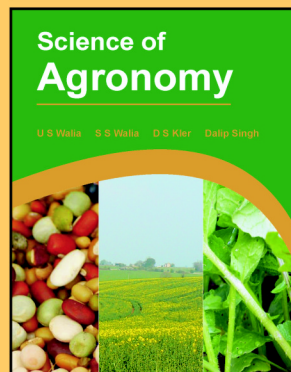
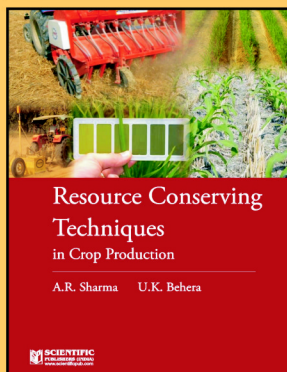
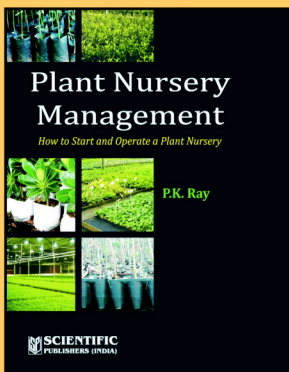
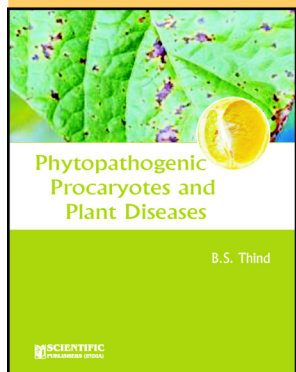
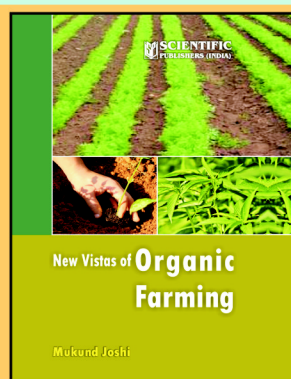
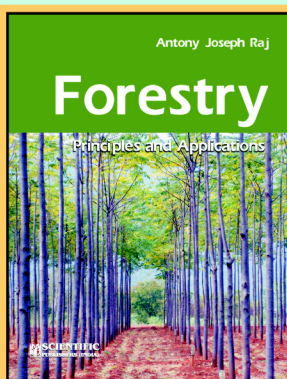
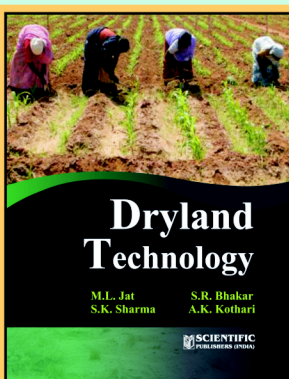
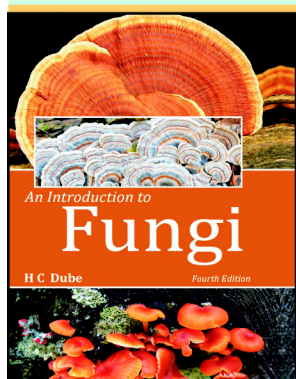
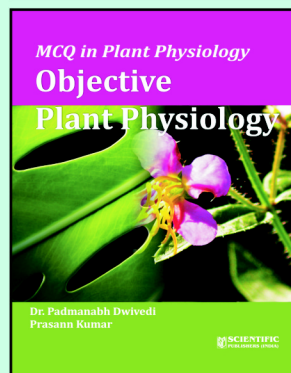
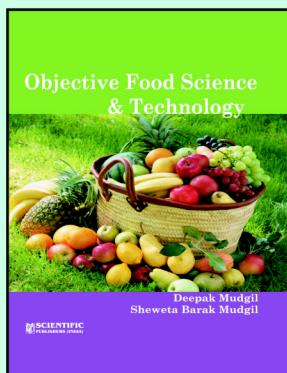
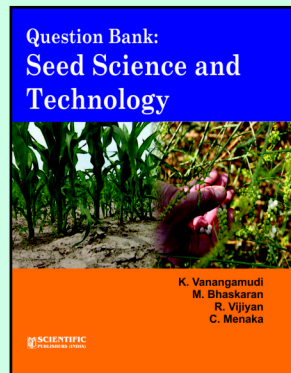
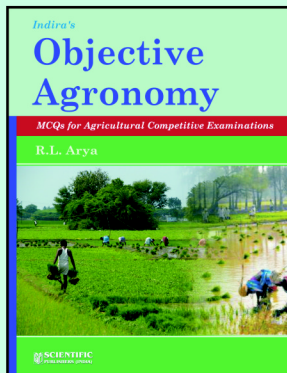
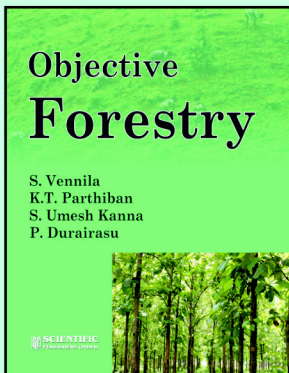
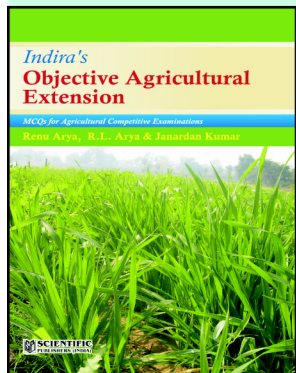
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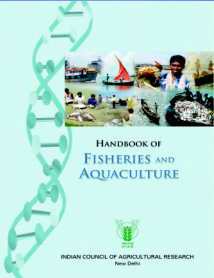
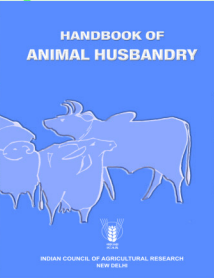
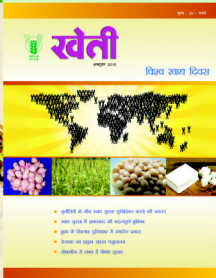
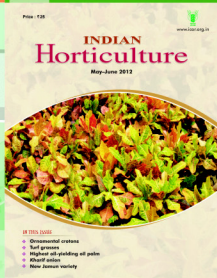
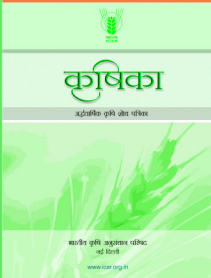
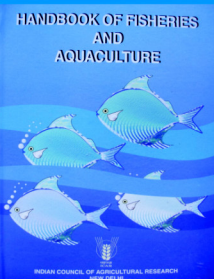
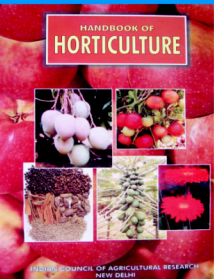
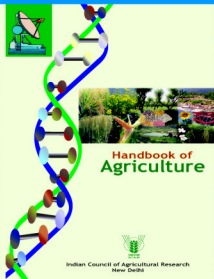
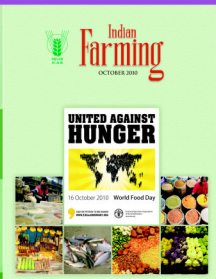




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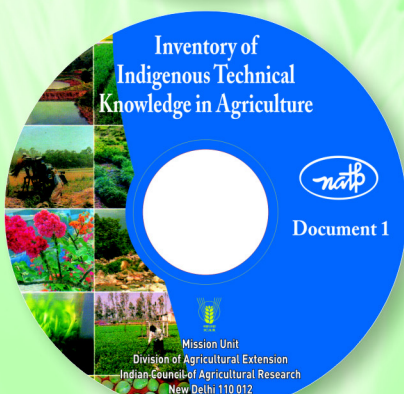
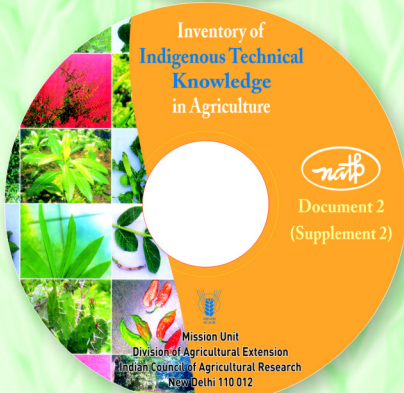
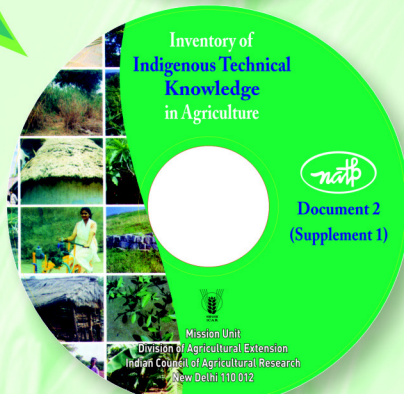
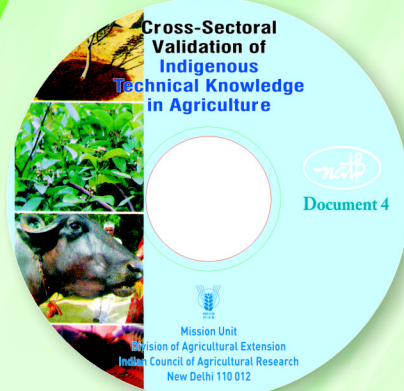


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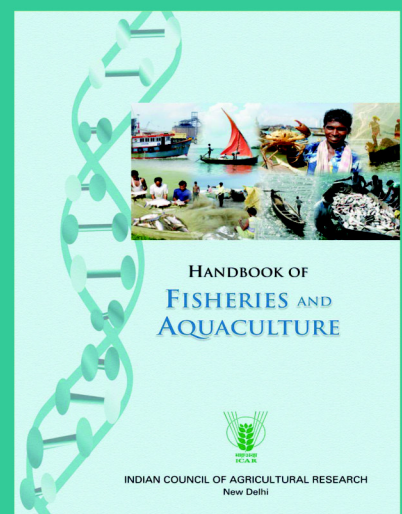
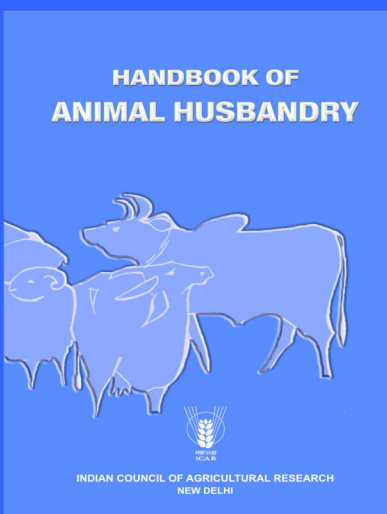
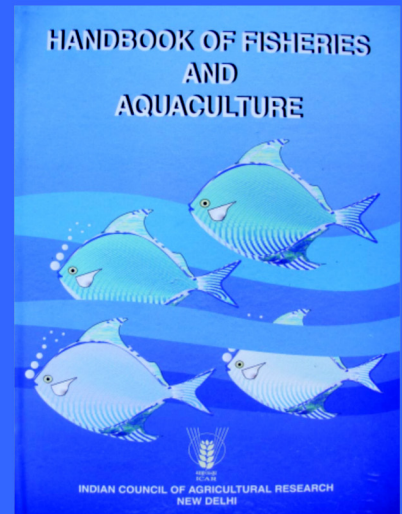
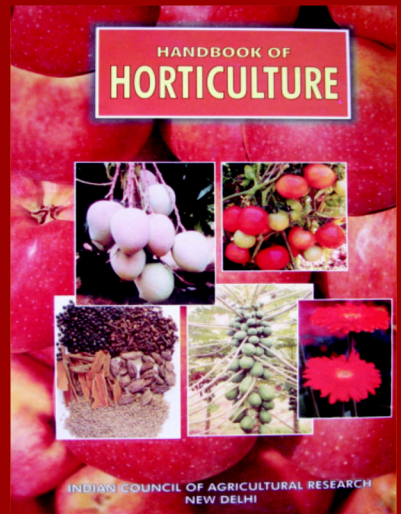
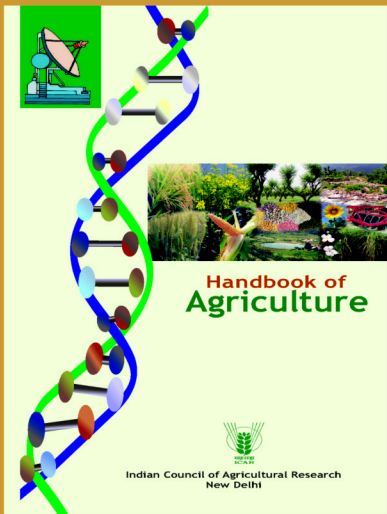


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