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Use pattern of agro-chemicals in ber based cropping system: ber grower's perceptions

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Abstract

The present study was conducted in Bikaner district of western Rajasthan. A total of 108 ber growers were selected for the study using purposive-cum-random sampling method. It was found that during kharif season, 8-36% ber growers grow various vegetables as intercrops in ber orchards on area ranging from 0.1-1.2 ha. During rabi season, 9-32% ber growers grow several Rabi vegetables/wheat/mustard/gram/green fodders/cumin/fenugreek (seeds) as intercrop in ber orchards on area ranging from 0.1-1.1 ha. Some of the ber growers grow some vegetables as intercrops in ber orchards during the summer season also.

It was also observed that 37-86%, 48-89% and 17-29% ber growers use various fungicides, insecticides and nematicides, respectively to control the insect pests and diseases in ber and vegetable intercrops grown in ber orchards. The chemical fertilizers (Urea, DAP, SSP) is used by 32-98% ber growers in ber based cropping system. However, the ber growers are unhappy with use of agro-chemical (Fungicides, insecticides, fertilizers, etc.) in their crop production. They perceive that the use of agro-chemicals in crop production leads to "poisoning and degradation of the soil quality/properties, degradation in quality and tests of the crop produces, crop produces become unhealthy and poisonous, induce the diseases and disorders in human being and animals body, reduce biodiversity, contaminate the ecological food chain, pollute the irrigation water, decrease the soil fertility, dangerous to crops and other economic plants, induce paralytic effect on human and animals limbs, increase soil drought and pollute the air, water bodies and ground water.

Key words: *Bikaner, ber, inter crop, insecticide, fungicide, fertilizer*

Introduction

Ber *(Ziziphus mauritiana* L.*)* is an important indigenous fruit of Indian subcontinent. It is grow to almost some extent in almost all the states of India. The tree is drought hardy and can grow under the most hazardous and harsh climatic conditions. Amongst the fruit trees, ber cultivation requires least input and care. It can give good yield with assured income even under rainfed and marginal growing conditions. It has been proved by the horticulturist that the arid environment of western Rajasthan is most suitable for production of high quality ber fruits. In recent years, the farmers of western Rajasthan have adopted various commercial improved verities of ber on large scale and as a conseqence of which area and production under ber crop is increasing day by day in this region. The farmers in these regions grow vegetables, pulses, legumes and oilseeds in ber orchards as inter crops to obtain extra income from per unit of land and better utilization of resources. Today, ber based cropping system is one of the most successful and emerging system of crop production in arid eco-system. However, the attack of pests and diseases on ber and ber based cropping system is a major problem before the ber growers. Low soil fertility level also have negative impact on progress of the above cropping system.

To manage the above problems in ber based cropping system, the farmers use various agro-chemical like chemical pesticides/ fungicides/insecticides and fertilizers. However, the farmers are not satisfy with the use of above agro-chemicals as they perceive that these chemicals are harmful from the ecological point of view. But there are no authentic data which can make clearly demarkate the present use pattern of agro-chemicals and farmers perception about bad impact of these chemicals on ecological/ environmental aspects. Keeping the above fact in mind, the present study was conducted in Bikaner district of western Rajasthan with the following objectives.

1. To evaluate the use pattern of agro-chemical in ber based cropping system.
2. To assess the farmer's perceptions about negative impact of agro-chemicals.

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Materials and methods

The present study was conducted in Bikaner district of western Rajasthan. The Bikaner district consist of eight revenue Tehsil. Out these, three Tehsils namely Bikaner, Nokha and Kolayat Tehsil were selected purposively for the study. Ber growing villages of each Tehsils were identified and listed (with the help of secondary information available at each Tehsil headquarter and consultation with extension agents/ state Govt. deptt. of horticulture/ agriculture). Twelve villages were selected randomly from above so listed ber growing villages of each Tehsil. Thus, a total of 36 ber growing villages were selected from the above three Tehsils. Further, all the ber growers of selected 36 villages were listed one by one and out of these, three ber growers were selected from each villages for the study. Thus, a total of 108 (total sample size) ber growers were selected amongst all three selected Tehils of the district for the study using purposive-cum-random methods of sampling. The selected respondents (ber growers) were personally contacted, interviewed and their response were recorded on semi-structured interview schedule.

The perception of ber grower's (respondents) about impact of agro-chemicals on ecological/environmental aspects were recorded on a five continuum scale i.e. strongly agree, agree, undecided, disagree and strongly disagree. The scoring 5,4,3,2 and 1 was allotted to response strongly agree, agree, undecided, disagree and strongly disagree, respectively. The statistical tools like scores, percentage, ranks etc. were used for statistical analysis of data and drawing the conclusion and inferences of the study.

Results and discussion

The socio-economic status of the farmers play very important role in adoption of any improved technology and capacity building of them for crop production. During the present study, the socio-economic status of the ber growers (respondents) was also assessed which is described below.

Socio-economic status of the ber growers.

The socio-economic status of the ber growers is presented in Table 1. From the table it could be seen that the majority (53.70%) of the ber growers were middle age group while few were of old age group. The educational status of the ber growers was very poor. The majority of them were have primary and middle standard education, only a few (17.60%) ber growers were graduate and postgraduate level. Majority (48.15%) of the ber growers belonged to other backward caste (OBC) and second majority of ber growers belonged to general caste. None of the ber growers belonged to schedule tribe category. It was also observed that about fifty per cent (47.22%) ber growers were of high income group who could earn more than one lakh annually from all the sources. There were ber growers which had large size (>9 ha) of land holding and second majority was of medium farmers. It was also observed that the majority (46.30%) of the ber growers had low extension orientation i.e. their participation in extension programme was low. There were only 25.0% ber growers who had high extension orientation. Thus, it may be said that the overall socio-economic status of the ber growers was not good.

Table 1. Socio-economic status of ber growers (respondents)

Variable	Total Sample size (ber growers)=108 Frequency of ber growers	ber growers (in%)
A. Age:		
1. Young (18-35 yrs)	29	26.85
2. Middle age (36-50 yrs)	58	53.70
3. Old (>= 51 yrs)	21	19.45
B. Education:		
1. Illiterate	07	06.48
2. Functional literate	15	13.88
3. Primary School	28	25.93
4. Middle School	22	20.37
5. High School	17	15.74
6. Graduate	13	12.04
7. Post Graduate	06	05.56
C. Caste:		
1. SC	19	17.59
2. ST	00	00.00
3. OBC	52	48.15
4. GEN	37	34.26
D. Annual income:		
1. Low (20000-50000)	20	18.52
2. Middle (51000-100000)	37	34.26
3. High (>= 10,0000)	51	47.22
E. Size of land holding:		
1. Small (1.1-2.0 ha)	14	12.96
2. Medium (4.1-9.0 ha)	41	37.96
3. Big (>9.0 ha)	53	49.08
F. Extension Orientation:		
1. Low (Score up to 33)	50	46.30

Intercrops grown in ber orchards.

The ber based cropping system in arid environment of western Rajashtan is one of the most important emerging system of crop production. The area under this system is increasing day by day and various vegetable and other crops are grown in the interspace of ber orchards as intercrops.

Table 2, reveals that during kharif season, 8-36 per cent of the ber growers grow mateera, snap melon, kachri, bottle gourd/round melon/ridge gourd/ brinjal / chilli /tomato /onion/ Indian aloe/cluster bean/groundnut/moth bean, in an area ranging from 0.1-1.2 ha. as intercrops for generating extra income and for better utilization of available natural and human (family labour) resources. Similar findings have

been reported by Sharma and Khurana (2000), that majority of the farmer grow pulses (moong, mash, cowpea), vegetables, oilseeds as intercrops in mango orchards in Gurdaspur district of Punjab.

Table 2. Intercrops grown by ber growers in ber orchards.

Season		Intercrops in ber Orchards	Area (in ha.)	Percentage of growers
(a) Kharif	(i)	Mateera/Snap melon/Kachri	0.2-1.0	12-23
	(ii)	Bottle gourd/ roundmelon/ ridgegourd	0.1-0.4	8-18
	(iii)	Brinjal / chilli/tomato /onion/Indian aloe	0.1-0.7	14-22
	(iv)	Cluster bean/groundnut /moth bean	0.5-1.2	19-36
(b) Rabi	(i)	Brinjal/onion(green) /tomato/Indian aloe	0.1-0.5	12-20
	(ii)	Cauliflower/cabbage	0.1-0.3	9-16
	(iii)	Spinach/fenugreek (leaves)/coriander (green)	0.1-0.3	18-26
	(iv)	Cumin(seeds)/ fenugreek(seeds)	0.5-1.1	14-32
	(v)	Radish/carrot/Pea	0.2-0.4	13-23
	(vi)	Wheat/mustard/gram /green fodders	0.2-1.0	11-16
(c) Zaid (summer season)	(i)	Mateera/snap melon /kachri/Tar kakadi	0.3-0.7	14-26
	(ii)	Bottle gourd/ridge gourd/round melon	0.1-0.4	10-18
	(iii)	Brinjal/ tomato /chilli/cluster beam (veg.)/cowpea	0.1-0.6	12-19
	(iv)	Spinach/Amaranthus /onion(green)	0.1-0.2	7-15

Similarly, during Rabi season 9-32 per cent ber growers, grow cauliflower/cabbage/spinach/fenugreek (green)/ Indian aloe/radish/carrot /pea/wheat/mustard/ gram/green fodders/cumin (seeds)/ fenugreek (seeds) in an area ranging from 0.1-1.1 ha. as intercrop in ber orchards.

It was also reported that the farmers who had irrigation facilities, grow vegetable crops in ber orchards during summer (zaid) and 7-26 percent ber growers, grow spinach/ round melon/ brinjal/ tomato/ chilli/ cluster bean (Vege.)/ cow pea, Mateera/ snap melon/ kachri as intercrop in ber orchards during the same season on a small scale (0.1-0.7 ha) to get extra income and multi-utilization of available resources.

However, the severe attack of insect-pests and diseases and low fertility status of soil of the region affect the ber based cropping system of the farmers negatively. Therefore, the farmers (ber growers) use various agro-chemicals to manage the above problems.

Agro-Chemicals used in ber based cropping system

The major agro-chemicals (fungicides/bactericides, insecticides/ fumigants, nematicides, chemical fertilizers, etc.) used by the ber growers to protect their ber and component intercrops from the attack of insect-pests and diseases and to manage the soil fertility are presented in Table-3.

The Table 3, reveals that 37-86 per cent ber growers use various fungicides/bactericides like bavastin, benomyl, thirum, mancozeb, ridomil MZ, Karathene, topsin, streptomycin/agrimycin, zineb, chlorneb, etc. to control the various diseases like powdery mildew/downy mildew, bight, root rot, fruit rot, leaf spot/anthracnose in intercrop vegetables, mustard, ber, pomegranate, etc. grown in ber orchards. The ber growers, purchase these fungicides/ bactericides from local markets, shopkeepers, pesticide agencies and use them on their crops in uncontrolled manner through seed treatment or foliar spray or soil treatment.

Further Table 3 reveals that majority (48-89%) of the ber growers use excess of insecticides/fumigents to control the attack of insect-pests either on ber or intercropped vegetables. The major insecticides/fumigants used by the ber growers are cholropyrifos, acephate, quinalphos, endosulfan, methylparathion, themate, roger, phosphamidon, monocrotophos, fenvalerate, malathion, dimethoate, carbaryl, phorate, etc. These insecticides are used through foliar spray or applied in soil in granular or powder form or with irrigation water to control different insect-pests. Shaik, and Bhal (2000) also stated similar findings in their study conducted in Delhi state. They reported that 27-63% vegetable growers used endosulfan, malathion and cypermethrin chemicals pesticides to protect their raddish, turnip, brinjal, tomato and cucumber crops from the attack of pests and diseases.

The attack of nematode in vegetable crops like brinjal, chilli, tomato, etc. is a very serious problem in arid regions as reported by the farmers. About 17-29 per cent ber growers use some nematicides/ fumigants to control the attack of nematodes. The major nematicides/funigants used by ber growers were: nemagon, vapam, carbofuram, aldicarb, phenumiphos, etc. to avoid the attack of nematodes in their intercrop vegetables. Some of the Vegetable growers use zinc phosphide in the form of bait to control the attack of rodents/ rats in their vegetable fields. But due to the religious aspects, the rodenticides were used by a few farmers only.

The soil of the arid regions are sandy and very much poor in fertility. Therefore, 32-98% of the farmers use chemical fertilizer like urea, diammonium phosphate (DAP), single super phosphate (SSP) murate of potash (MOP), etc. in the cropping system. Majority of the ber growers use urea and DAP in growing ber itself and vegetable, groundnut, mothbean, wheat, mustard, cumin, fenugreek, etc. in ber orchards for higher and quality of production.

Table 3. Agro-chemicals used by ber growers in ber based inter-cropping system.

Group of agro-chemical used	agro-chemicals used	Mode of application	Percentage of adopters (ber growers)
(i) Fungicides/ Bacteriocides	Bavistin, Benomyl (Benlate), Thiram, Mancozeb, Ridomil MZ, Karathene, Topsin, Streptomycin, Agrimycin, Dithane Z-78 (Zineb), dichlone, etc.	Through seed treatment, foliar spray and soil treatment to control diseases	37-86
(ii) Insecticides	Chlorpyriphos, Acephate, quinalphos, Endosulfan, Methylparathion, Themate, Roger, Phosphamidon, monocrotophos, fenvalerate, malathion, Dimethoate, Carbaryl, Phorate, etc.	Through dusting, foliar spray and soil treatment to control insect pests.	48-89
(iii) Nematicides/ fumigents	Nemagon, Vapam, carbofuran, Aldicarb, Phenumiphous	Through fumigation/ drenching/soil treatment to control nematodes and other insects.	17-29
(iv) Rodenticide /Raticide	Zinc Phosphide	Through baiting to control the rats in vegetable fields.	18-32
(v) Chemical Fertilizers	Urea,/Diamonium phosphate/Single super phosphate/Murat of potash, etc.	Through soil and foliar application to increase soil fertility and productivity	32-98

Table 4. Perceptions of ber growers regarding mischievous impacts of agro-chemical's

Perceptions	Sectional Ranking (PMS*=540) Scores	Rank	Overall Ranking
Section-A: Impact on Soil System/components			
1. Poisoning and degradation of soil quality/properties	356	1	1
2. Death of soil micro flora and fauna	232	3	11
3. Increase the soil droughtness	181	4	16
4. Affact water and nutrient availability	146	5	19
5. Decrease the soil fertility	264	2	8
Section-B: Impact on water quality/requirement			
1. Pollution of irrigation water	277	1	7
2. Pollution of water bodies and ground water	209	2	13
3. Increase the demand of irrigation	167	3	18
Section-C: Impact on plant growth, yield & quality			
1. Dangerous for crops and other economic plants	244	3	9
2. Degradation of the quality and test of produces	346	1	2
3. Crop produces become unhealthy/ poisonous	333	2	3
4. Induce localized deformities in plant system	189	4	15
Section-D: Impact on human and animals health			
1. Induce the diseases and disorders	329	1	4
2 Induce Paralytic effect on human and animals limbs	242	2	10
3. Reduce the working capacity and productivity of human being/animals.	133	4	20
4. Reduce resistance power of animal/human body	179	3	17
Section-E: Impact on other environ-ecological aspects:			
1. Reduction of the biodiversity	321	1	5
2. contamination of ecological foodchains(food,feed and fodder sources)	308	2	6
3. Pollution of the air	202	4	14
4. Dangerous for existence of wild life	219	3	12

***PMS= Possible Maximum Scores.**

However, the ber growers are not happy with use of different agro-chemicals in growing their crops. The farmers apprehend that the agro- chemicals are dangerous and have bad impact on their crop fields, irrigation water, quality of products, human health and other environmental/ ecological aspects. The farmers perceive that the use of agro-chemical in crop production are harmful and very risky from the ecological point of view.

Perceptions of ber growers regarding negative impact of agro- chemical's used.

Perception of ber growers regarding negative impact of agro-chemicals used in crop production was evaluated under different sections.

Table 4, reveals that amongst the impact of agro-chemicals on soil system/ components as perceived by the ber growers were "poisoning and degradation of soil quality/ properties, decrease the soil fertility, death of soil micro flora and fauna and increase the soil drought," which were ranked first, second, third, and fourth with score 356, 264, 232 and 181, respectively. Amongst the impact of agro-chemicals on water quality/requirement as observed by ber growers were "pollution of irrigation water, pollution (Poisoning) of water bodies and ground water and increase the demand of irrigation," which were rank 1st, 2nd,and 3rd with score 277, 209 and 167 respectively. "The degradation of the quality and test of the produces, produces become unhealthy/poisonous, dangerous for crops and other economic plants and induce localized determities in plant system," were major bad impact of agro-chemicals on plant growth, yield and quality of produces as reported by the ber growers. These findings are on the line of the findings as reported by Rao, (1994).

Amongst the impacts of agro-chemicals on human and animal health's as perceived by the ber growers were that they "induce the disease and disorders, induce the paralytic effect on human and animal limbs, reduce the resistant power of human being and animals and reduce the working capacity and productivity of human being and animals which were ranked by the ber growers as first, second, third and fourth bad impact of agro-chemical with scores 329, 242, 179 and 133, respectively. Nair, (1996) reported that the pesticides are fatal to environment and human health. The pesticides have chronic effect on human being like inducing cancer, genetic mutations, damage to immune system, kidney, liver etc.

The impact of agro-chemicals on environmental/ ecological aspect as viewed by the ber growers, were "reduction of the bio-diversity, contamination of ecological food chain (food, feed and fodder sources), dangerous for existence of wild life and pollution of air which were ranked 1st, 2nd, 3rd, and 4th with score 321, 308, 219 and 202 respectively. These are supported by the findings of Potter (1965) and Piementel *et. al.* (1992). They reported that the heavy use of pesticides had poisoning impact on food stuff and contaminate the environment. They disturb the ecological processes and affect the normal life of domestic animals, vegetation, flora and fauna and wife life, etc.

The conclusion of this study is that about 1/3 population of ber growers grow various vegetables as intercrops in ber orchards during kharif, rabi and zaid (summer) season of the year. Majority of ber growers use several agro-chemicals (fungicides, insecticides, nematicides, rodenticides and chemical fertilizers) in their ber based cropping system. However, they were not satisfied with the use of agro-chemicals in their crop production system. They apprehended that these agro-chemical have bad impact on environmental/ecological aspects. They have ill effect on biodiversity, ecological food chain, soil fertility and soil micro- organism. Hence, the farmers should be trained and guided for scientific and environmental safe use of agro-chemicals in their crop production. They should be motivated for adoption of organic farming system in horticultural crop production. The organic farming system, integrated nutrient management, integrated pests and diseases management, biopesticides, organic manures, etc. should be popularized amongst the farmers/ber growers of arid region so that they may adopt these practices for better horticultural crop production with minimum environmental risk.

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