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MANAGEMENT OF DRYLAND SUSTAINABLE AGRICULTURE

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Abstract

The study was conducted in the Bhiwani district of Haryana state, which was selected purposively on the basis of maximum area under dryland agriculture. From the four blocks in the Bhiwani district 200 farmers (50 farmers from each block) were selected randomly.

The concept of sustainable agriculture involves the evolution of a new type of agriculture rich in technology and information, with much less than intensive energy use and market purchased inputs. Thus, sustainability is the successful management of resources to satisfy the challenging human needs, while maintaining or enhancing the quality of environment and conserving natural resources. Keeping in view the ever-increasing population, development of dry land agriculture, the depletion of natural resources, environmental pollution and limitations of sustainable agriculture a study was conducted to find out the perception of dryland farmers about economic and social aspects of sustainable dryland agriculture in Haryana (India).

The study revealed that majority of the farmers perceived minimum tillage, crop diversification, soil fertilization application, integrated nutrient management, weed control, integrated pest management, maintaining plant population, drought resistant varieties, moisture and water conservation practices, agro-forestry and subsidiary occupation like livestock, poultry, horticulture, vegetable etc., as economically feasible, viable, as well as socially acceptable and sustainable for sustainable dryland agriculture.

Introduction

The word sustainable, from the Latin, sustainers to keep in existence, implies permanence or long-term support. As it pertains to agriculture, sustainable describes farming systems that are "capable of maintaining their productivity and usefulness to society indefinitely. Such systems must be resource conserving, socially supportive, commercially competitive, and environmentally sound".

The concept of sustainable agriculture involves the evolution of a new type of agriculture rich in technology and information, with much less than intensive energy use and market purchased inputs. Thus, sustainability is the successful management of resources to satisfy the challenging human needs, while maintaining or enhancing the quality of environment and conserving natural resources. The twin words viz., improvement and productivity of agricultural crops are now seriously being viewed and examined in the context of sustainability parameters. With the increase in crop yields from modern farming techniques reaching a plateau and mounting environmental problems, the needs for the sustainable and ecological agriculture is increasingly felt in the country.

Rainfed/Dry land farming has a distinct place in Indian agriculture occupying 67 per cent of the cultivated areas, contributing 44 per cent of the population. Two-third of the Livestock lives in these regions. The resource poor infrastructure and low investment in technology and inputs characterize it. In the present times, the agriculture in our country is managed on the basis of natural resources that safeguard agricultural production. More often, emphasis is placed on the analysis of issues on sustainability of dry land agriculture system where selective farmers are switching over from modern intensive farming to other productive natural farm practices. Improvement of dry land/rain fed farming is a key to the development of agriculture and removal of poverty in rural areas.

Farmers all over the world are working as managers of their farm, irrespective of the economic, social, cultural, physical, technological and environmental; the farmers manage the production system to get returns from it. Effective management of agriculture extension has special relevance in Indian content where agriculture plays a key role in meeting food requirement and supporting raw materials.

Effective management is crucial for obtaining high returns from a production system on sustained basis. Therefore, it is essential that the farmers and extension personnel are made aware of the local resources for developing the managerial ability of the farmers to make them shift/move from traditional to cope up with new demands, new problems and new challenges.

Methodology

The study was conducted in the Bhiwani district of Haryana state. From the Bhiwani district all four blocks were selected and from these blocks two villages were selected. To make the study more comprehensive, from these villages 200 dryland farmers 25 farmers from each village) were selected to collect the information. A schedule was developed and data were collected at farmer's fields. For the measurement of perception of the respondents about economic aspects of sustainability, the dry land technology was divided into ten (10) broad components, which includes land preparation, crop diversification, soil fertility, weed control, integrated pest management, plant population adjustment, varieties of crops, soil and water conservation measures, agro-forestry, and subsidiary occupations. These broad components were sub-divided into specific technological components. Perception for the present study has been operationalised as the process by which respondents perceive the economical and social facets of sustainability. The perception of economical dimension of sustainability for the present study has been operationalized in terms of economic feasibility and economic viability. The economic feasibility (EF) refers to the capacity of farmers to afford to incorporate technology in his farm within his realm of financial status and position. The economic viability (EV) refers to the returns to investment of every rupee count. Similarly, the perception of social dimension of sustainability has been conceptualized in terms of social acceptability and social sustainability. The social acceptability (SA) refers to the extent to which technology is acceptable by the different sectors of the society. The social sustainability (SS) refers to the extent to which technology fulfils the personal needs of farmers. For the measurement of perception of the respondents about economic and social aspects of sustainability, the dry land technology was divided into ten (10) broad components, which includes land preparation, crop diversification, soil fertility, weed control, integrated pest management, plant population adjustment, varieties of crops, soil and water conservation measures, agro-forestry, and subsidiary occupations. These broad components were sub-divided into specific technological components. The respondents were asked to indicate perception of each component in terms of economic feasibility (EF), economic viability (EV), social acceptability (SA), and social sustainability (SS).

Results And Discussion

The results of the findings are presented in the following head and sub-heads:

Land Preparation:

The data in Table 1 speaks that a majority (74.50%) of the dry land farmers perceived minimum tillage as economically feasible, followed by 47.50 per cent that perceived it as economically viable, 60.00 per cent farmers perceived as socially acceptable and 67.50 per cent of them perceived the minimum tillage as socially sustainable. However, 25.50 per cent 52.50 per cent,31 per cent and 32.50 per cent of the farmers perceived that minimum tillage was not economically feasible, economically viable, socially acceptable and sustainable, respectively.

Crop Diversification:

It is observed from the Table 1 that an equal percentage (84.50%) of the farmers perceived crop rotation as economically feasible and viable while as the 100.00 percent of the farmers perceived it as socially acceptable and socially sustainable. Further it was resulted that 89.00 per cent farmers, followed by 73.50 per cent, 87.50 per cent and 75.00 per cent of them perceived mixed cropping as economically feasible, viable as well as socially acceptable and sustainable, respectively. As majority (65.00%) of the farmers, followed by 67.50 per cent, 84.00 per cent and 85.00 per cent of farmers perceived intercropping as economically feasible, viable, socially acceptable and sustainable, respectively. In case of vegetable production an equal percentage (65.00%) of the farmers perceived it as economically feasible and viable, whereas, 60.00 per cent of them perceived vegetable production as socially acceptable and sustainable. The 67.50 per cent, followed by 57.50 per cent, 90.00 per cent and 85.00 per cent of the farmers perceived the dairy farming as economically feasible, viable, socially acceptable and sustainable, respectively. As for as bee-keeping is concerned, 30.00 per cent of the farmers perceived it as economically feasible and majority of them (60.00%, 70.00%, 77.00% and 74.00% respectively) perceived as viable, socially acceptable and sustainable, respectively. In case of poultry, 25.00 percent, 35.00 per cent, 45.00 per cent and 39.00 per cent farmers respectively, perceived it as economically feasible, viable, socially acceptable and sustainable.

Soil Fertility:

(a) Soil Fertilization

The data from the Table 1 reveals that majority (74.00%) of the farmers perceived broadcasting of fertilizers as economically feasible, followed by 30.50 per cent of them who perceived this practice as economically viable, while as 78.00 per cent and 83.00 per cent of the farmers perceived it as socially acceptable and sustainable, respectively. The banding use of fertilizer placement was perceived by 69.00 and 35.00 percent of the farmers as economically feasible and viable whereas, majority (83.00%) and (79.00%) of them who perceived this technique as socially acceptable and sustainable.

(b) Integrated Nutrient Management

The perusal of data from the Table 1 indicates that 25.00 per cent and 75.00 per cent of farmers perceived fertilizer application as economically feasible and viable while as 62.00 percent and 64.00 per cent of them perceived as socially

acceptable and socially sustainable. On the other hand 75.00 per cent, 50.00 per cent, 38.00 per cent and 36.00 per cent of the farmers not perceived this practice as economically feasible, viable, socially acceptable and sustainable, respectively. As for as biofertilizer under integrated nutrient management is concerned, 27.50 per cent and 50.00 per cent of the farmers perceived this as economically feasible and viable whereas 10.00 per cent and 11.00 per cent of them as socially acceptable and sustainable. In case of crop residue, 88.00 per cent, followed by 84.00 per cent of the farmers perceived it as economically feasible as well as economically viable while as the use of crop residue perceived by 73.00 per cent and 82.00 per cent of them as socially acceptable and sustainable, respectively. The use of green manure was perceived by majority (90.00%, 85.00%, 80.50% and 86.00%) as economically feasible, viable, socially acceptable and sustainable, respectively. As for as legume cropping is concerned, it was found that the majority of the farmers (70.00%, 65.00%, 67.50% and 65.00%) perceived this operation as economically feasible, viable, socially acceptable and sustainable, respectively.

Weed Control:

The Table 1 indicates that an majority of the farmers (85.00% and 90.00%), followed by an equal 100.00 of them perceived cultural method of weed control as economically feasible, viable, socially acceptable and sustainable, respectively. The same was the trend in case of mechanical method of weed control to the extent of 97.50 per cent, 95.00 per cent and an equal 100.00 per cent of the farmers. In case of crop rotation an majority (95.00% and 90.00%) of the farmers, followed by an equal 100.00 per cent perceived this technique of weed control as economically feasible, viable, socially acceptable and sustainable, respectively. The use of chemicals for weed control perceived by 45.00per cent, 42.50 per cent, 55.00 per cent and 60.00 percent of the farmers as economically feasible, viable, socially acceptable and sustainable.

Integrated Pest Management:

The perusal of the data from the Table 1 reveals that an equal 90.00 per cent of the farmers, followed by 79.50 per cent and 52.50 per cent of them perceived cultural method of pest control as economically feasible, viable, socially acceptable and sustainable, respectively. Summer ploughing was perceived by a majority (86.00% and 82.00%) of the farmers followed by an equal 100.00 per cent of them as economically feasible, viable, socially acceptable and sustainable as a method of pest control. Regarding hand collection and destruction method of pest control 85.00 per cent, followed by 81.00 per cent of the farmers perceived it as economically not feasible and viable while an equal 40.00 per cent of them perceived this technique as socially not acceptable and sustainable. In case of biological method of pest control 21.50 per cent and 26.00 per cent of the farmers perceived as economically feasible and viable, followed by an equal 100.00 per cent perceived as socially acceptable and sustainable. The use of insecticides/pesticides to control insect pest it was found that an equal 24.50 per cent of farmers, followed by 90.00 per cent and 85.00 per cent of them perceived it as economically feasible, viable, socially acceptable and sustainable, respectively.

Maintaining Plant Population:
The Table 1 reveals that a Majority (79.00%, 67.50%, 97.50% and 87.50%) of the farmers perceived this technique as economically feasible, viable, socially acceptable and sustainable, respectively.
Drought Resistant Variety (DRV):The Table 1 indicates that 87.50 per cent of the farmers, followed by 85.00 per cent and an equal 100.00 per cent of them perceived introduction of drought resistant variety as economically feasible, viable, socially acceptable and sustainable, respectively.

Moisture and Water Conservation Practices:
It is concluded from the data in Table 1 that a majority (86.00% and 79.00%) of the farmers, followed by an equal 100.00 of them perceived farm ponds as economically feasible, viable, socially acceptable and sustainable, respectively. 90.00 per cent, followed by 75.00 per cent of them perceived vegetative barrier as economically feasible and viable whereas an equal 100.00 per cent of farmers perceived this technique as socially acceptable and sustainable. Regarding mulching, 55.00 per cent, followed by 60.00 per cent, 60.00 per cent and 52.00 per cent of farmers who perceived it as economically feasible, viable, socially acceptable and sustainable, respectively. Summer ploughing was perceived by an equal 100.00 per cent to be economically feasible, viable, socially acceptable and sustainable.

Agro-forestry:
The data in Table 1 indicates that all 100.00 per cent of the farmers perceived agro-forestry as economically feasible, viable, socially acceptable and sustainable. This practice helps to maintain environment and gives extra income other than field crops to the farmers.

Subsidiary Occupation:
It is reveals from the Table 1 that all 100.00 per cent of the dry land farmers perceived livestock and dairying as economically feasible, viable as well as socially acceptable and sustainable. Regarding poultry as a subsidiary occupation, a majority (95.00%, 92.50%, 90.00% and 89.00%) of the farmers perceived it as economically feasible, viable, socially acceptable and sustainable, respectively. In case of horticulture, 75.00 per cent, followed by 62.50 per cent, 85.00 per cent and 82.50 per cent of the farmers perceived this practice as economically feasible, viable, socially acceptable and sustainable. Regarding vegetable as subsidiary occupation of the farmers 55.00 per cent, 42.50 per cent, 45.00 per cent and 50.00 per cent of them perceived as economically feasible, viable, socially acceptable and sustainable, respectively. As regards to bee-keeping, 30.00 per cent and 35.00 per cent of the farmers perceived it as economically feasible and viable whereas 50.00 per cent and 62.50 per cent of them perceived it as socially acceptable and sustainable as a subsidiary occupation.

In general, the conclusion regarding farmers' perception about technological components was that they had very good perception about tillage, crop diversification, soil fertility, integrated nutrient management, weed control, integrated pest management, maintaining plant population, moisture conservation measures, agro-forestry, livestock, dairying and poultry. This may be attributed to their better financial position and social status, etc.

- **Table 1 Perception of farmers about economic and social aspects of sustainability**

(N=200)

Sr. No.	Items	Economical aspect ECONOMIC FEASIBLE ECONOMIC VIABLE Yes No Yes No				Social aspect Social Acceptability Social Sustainability Yes No Yes No			
1.	Land Preparation Minimum tillage	149(74.50)	51(25.50)	95(47.50)	105(52.50)	138(69.00)	62(31.00)	135(67.50)	65(32.50)
2.	Crop Diversification								
	i. Crop rotation	169(84.50)	31(15.50)	169(84.50)	31(15.50)	200(0.00)	----------	200(100.00)	----------
	ii Mixed cropping	178(89.00)	22(11.00)	147(73.50)	53(26.50)	175(87.50)	25(12.50)	150(75.00)	50(25.00)
	iii Inter cropping	130(65.00)	70(35.00)	135(67.50)	65(32.50)	168(84.00	32(16.00)	170(85.00)	30(15.00)
	iv. Vegetable production	130(65.00)	70(35.00)	130(65.00)	70(35.00)	120(60.00)	80(40.00)	120(60.00)	80(40.00)

	v. Dairy farming	135(67.50)	65(32.50)	115(57.50)	85(42.50)	180(90.00)	20(10.000)	170(85.00)	30(15.00)
	vi Bee keeping	60(30.00)	140(70.00)	140(70.00)	60(30.00)	154(77.00)	46(23.000)	148(74.00)	52(26.00)
	vii Poultry	50(25.00)	150(75.00)	70(35.00)	130(65.00)	90(45.000)	110(55.00)	78(39.000)	122(61.00)
3.	**Soil Fertility (a). Soil Fertilization**								
	i. Broadcasting of fertilizer	148(74.00)	52(26.00)	61(30.50)	139((69.50)	156(78.00)	44(22.000)	166(83.00)	34(17.00)
	ii. Banding use of fertilizer	138(69.00)	62(31.00)	71(35.50)	129(64.50)	166(83.00)	34(17.000)	158(79.00)	52(26.00)

	(b).Integrated Nutrient Management								
	i. Fertilizer	50(25.00)	150(75.00)	100(50.00)	100(50.00)	124(62.00)	76(38.00)	128(64.00)	72(36.00)
	ii. FYM	200(100.00)	----------	200(100.00)	----------	200(100.00)	----------	200(100.00)	----------
	iii Biofertilizer	55(27.50)	145(72.50)	100(50.00)	100(50.00)	20(10.00)	180(90.00)	22(11.00)	178(89.00)
	Iv. Crop residue	176(88.00)	24(12.00)	168(84.00)	32(16.00)	146(73.00)	54(27.00)	164(82.00)	36(18.00)
	v. Green manure	180(90.00)	20(10.00)	170(85.00)	30(15.00)	160(80.00)	40(20.00)	172(86.00)	28(14.00)
	vi. Legume cropping	140(70.00)	60(30.00)	130(65.00)	70(35.00)	135(67.50)	65(32.50)	130(65.00)	70(35.00)

4.	Weed Control								
	i. Cultural method	170(85.00)	30(15.00)	180(90.00)	20(10.00)	200(100.00)	-----------	200(100.00)	----------
	ii. Mechanical method	195(97.50)	5(2.50)	190(95.00)	10(5.00)	200(100.00)	----------	200(100.00)	----------
	iii. Crop rotation	190(95.00)	10(5.00)	180(90.00)	20(10.00)	200(100.00)	00(0.00)	200(100.00)	----------
	iv. Chemical method	90(45.00)	110(55.00)	85(42.50)	115(57.50)	110(55.00)	90(45.00)	120(60.00)	80(40.00)

5.	**Integrated Pest Management**								
	i. Cultural method	180(90.00)	20(10.00)	178(89.00)	22(11.00)	159(79.50)	41(20.50)	105(52.50)	95(47.50)
	ii. Summer ploughing	173(86.50)	27(13.50)	164(82.00)	36(18.00)	200(100.00)	----------	200(100.00)	----------
	iii. Hand collection and destruction	29(14.50)	171(85.50)	38(19.00)	162(81.00)	120(60.00)	80(40.00)	120(60.00)	80(40.00)
	iv. Biological control	43(21.50)	157(78.50)	52(26.00)	148(74.00)	200(100.00)	----------	200(100.00)	----------
	v. Use of insecticides/ pesticides	49(24.50)	151(75.50)	46(23.00)	154(77.00)	180(90.00)	20(10.00)	175(87.50)	25(12.50)
6.	**Maintaining Plant Population**	158(79.50)	42(21.00)	135(67.50)	65(32.50)	195(97.50)	5(2.50)	175(87.50)	25(12.50)
7.	**Drought Resistant Variety**	175(87.50)	25(12.50)	170(85.00)	30(15.00)	200(100.00)	----------	200(100.00)	----------

8.	**Moisture and Water Conservation Practices**								
	i. Farm ponds	172(86.00)	28(14.00)	158(79.00)	42(21.00)	200(10.00)	----------	200(100.00)	----------
	ii. Vegetative barrier	180(90.00)	20(10.00)	150(75.00)	50(5.00)	200(100.00)	----------	200(100.00)	----------
	iii. Mulching	110(55.00)	90(45.00)	120(60.00)	80(40.00)	120(60.00)	80(40.00)	104(52.00)	96(48.00)
	iv. Summer ploughing	200(100.00)	----------	200(0.00)	----------	200(100.00)	----------	200(100.00)	----------
9.	Agro forestry	200(100.00)	----------	200(0.00)	----------	200(100.00)	----------	200(100.00)	----------
10.	**Subsidiary Occupation**								
	i.Live stock	200(100.00)	----------	200(100.00)	----------	200(100.00)	----------	200(100.00)	----------

	ii. Dairying	200(100.00)	----------	200(100.00)	----------	200(100.00)	----------	200(100.00)	----------
	iii.Poultry	190(95.00)	10(5.00)	185(92.50)	15(7.50)	180(90.00)	20(10.00)	178(89.00)	22(11.00)
	iv. Horticulture	150(75.00)	50(25.00)	125(62.50)	75(7.50)	170(85.00)	30(15.00)	165(82.50)	35(17.50)
	v. Vegetable	110(55.00)	90(45.00)	85(42.50)	115(57.50)	90(45.00)	110(55.00)	100(50.00)	100(50.00)
	vi. Bee keeping	60(30.00)	140(70.00)	70(35.00)	130(65.00)	100(50.00)	100(50.00)	125(62.50)	75(37.50)

Figures in parentheses indicate percentage