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Identification and Removal of Constraints of Sustainability in Wheat Crop

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ABSTRACT

The sustainability is a broader term. It cannot be addressed in isolation .However every small effort can contribute towards sustainability An experiment was conducted at the farms of Khalsa College Amritsar to find the low cost alternative practices for wheat crop. The results of the experiment revealed that weeds of wheat crop can be controlled and nutritional requirements of the crop can be fulfilled by growing legume pulse crop gram instead of using herbicides and fertilizers respectively. Mulching the waste paddy straw in the field can reduce the problem of weeds. All these sustainable practices can lead to reduction in cost of production and a better benefit cost ratio for the farmers. These practices also tackle with the problem of environmental pollution due to burning of the paddy straw which causes a serious threat to the climate of Punjab during the harvesting days of paddy.

Keywords : Wheat, cost of production, sustainability, Q01.

1. INTRODUCTION

Sustainable agriculture is a key element of sustainable development and is essential to the future well being of the human race and planet. Sustainable agriculture needs to be economically viable, environmentally sound and socially acceptable.

But achieving all these objectives of sustainable agricultural development which are challenging as well as contradictory will be altogether more difficult in future. Agriculture production system will bound to be under stress of biotic and a biotic resources.

The present system of agriculture neglect the rain fed and marginal areas. However this area comprises more than two third proportion of total cultivated area. The agricultural technology called seed water fertilizer technologies being successful only in the northern region of India. And it was thought that this is the only way of a faster agricultural development that ignored the agricultural development of those regions where assured irrigation facilities were not available.

Increasing competition for land, water and energy will intensifies due to their pressing demands for housing and industrialization; and thus there is high probability of their diversion from agriculture. These challenges will be aggravated further by increasing frequency of extreme climatic events, such as draughts, floods cyclones, heat waves etc.

Punjab, popularly known as the 'grainary of India' with just having 1.52 percent of land area of India contributed around 50 percent to national pool of food grains. Since the 1960's a number of factors such as high-yielding varieties of wheat and rice, higher use of fertilizers, expansion in irrigation and increased cropping intensity has benefitted the state as well as the farmers by increasing the production and hence the incomes of the farmers. But the last decade of twenty first century has shown many problems creeping up in the economy of once prosperous agricultural economy of the country. It poses a serious question towards the future sustainability of such farm practices in the state agriculture.

The Persistent cultivation of rice and wheat cropping pattern on 80 percent of cropped area over a long period of time led to reduction in fertility of soil which further led to highest consumption of chemical fertilizer per hectare. Since this cropping pattern require assumed irrigation facilities throughout the year coupled with the policy of the state government providing free electricity for agricultural use has led to the depletion of ground water sources. Farm level concerns on ground water depletion and consequent water scarcity emerge from rising investment on deepening of tubewells, increasing cost of irrigation due to diesel usage and expected yield and income losses translating into food and livelihood insecurity (Sidhu *et al.,* 2011). Excessive use of insecticides and pesticides on the one hand led to the degradation of soil and water sources and reduction of farm incomes on the other hand which led to the frequent rise in the number of suicides of farmers in the state. Besides this, small size of land holdings, frequent obsolesce of expressive agricultural machinery, year to year fluctuation in market prices of rice, rural indebtness due to excessive spending on marriages and other customs led to dire resources crunch in the form of squeezing farm incomes.

This scenario requires development of such type of farm technologies and practices which may lead to reduction in cost of production and hence rise in income of farm community which may further lead to betterment of the farmers as a whole. This study seeks to develop the Economics of cost effective strategies for cultivation of wheat in Punjab and rainfed areas which helps to increase the profitability of growing such traditional crops on the one hand and conserving the quality of soil as well as the ground water levels on the other hand.

1.1. Removal of Constraints: an approach for possible solutions in Wheat crop

In conventional farming weeds are controlled with the help of weedicides which is costly input and it takes major share of cost of cultivation. Cultural methods such as crop rotation, method of sowing, mulching (Straw and live) and time of sowing etc. the agronomic manipulations can prove quite useful in dealing with

the problem of weeds. So there is need to identify non-monetary techniques of weed control which may reduce its cost. Among different techniques variable plant density, crop geometries, method of sowing, mulching etc. are important one.

Planting pattern is an important factor which influences micro-climate including light penetration and interception thereby influencing growth and yield of crop.Bed planting has shown improved water distribution and efficiency, reduced weed infestation and crop lodging. It facilitates to reduce dependence on herbicides besides employing hand weeding and applying mulches between rows easier. In bed planting the population and dry matter production of *Phalaris minor (*a major weed of wheat*)* was found to be decreased by 14.8 and 12.7 percent, respectively compared to flat planting (Bhat *et al*., 2006).

This single commodity oriented system lead to nutrient drains as nutrients extracted from the system are not replenished back which is the backbone of sustainable agriculture. Very few technologies have been developed for returning nutrients from consumer to producer area which could even have the potential to solve the problem of organic waste management.

Mulching is the practice of covering the soil with any material such as paddy straw or wheat straw etc.It suppresses weeds and helps in conserving soil moisture, improving physical, chemical and biological properties of soil, holds rain water at the soil surface there by providing enough time to infiltrate into the soil. Mulching also has its effect on the soil temperature. It had smothering effect on weed population. Mulching with paddy straw, which is easily available provides solution for rice straw management also.

In conventional system focus of the production is single commodity. Similarly technological developments are also in favour of single commodity. As before green revolution, there was sufficient area under pulses, gram, oilseeds etc but due to the development of this technology, Punjab came under the grip of rice wheat monoculture making little technical development for the other crops. This has hindered the sustainable system by reducing positive interactions between different plants, animal and man. Live legume mulch or inter cropping also curb down the menace of weeds by smothering them through greater shading and by competing for other environmental factors. Legume crop, in addition to live mulch action in cereal crop, also fix atmospheric nitrogen leading to increased productivity and soil heath. at the same time it has the capacity to save the farmers from the various problems of monoculture. So, live legume mulch can be maintained throughout the growing season with the main crop.

2. OBJECTIVES

1. To manage the waste and adding nutrients in the form of crop residue i.e. mulching of rice straw to maintain soil health.
2. To reduce cost of production through elimination of chemical fertilizers and improve the soil health by growing legume crop (gram) as intercrop.
3. To improve water use efficiency through bed planting.
4. To reduce cost of production by avoiding weedicides through planting patterns like row spacing which help in weed suppression

   To see the integrated impact of all these sustainable practices on cost, returns, profitability of wheat and their contribution to environmental improvement.

3. REVIEW OF LITERATURE

Banik *et al.* (2006) reported reduction in weed biomass and weed population under the intercropping of wheat-chickpea compared to unweeded monocrop wheat. Sarunaite *et al.* (2010) evaluated the effect of intercropping spring wheat with grain legume for increased production and reported that the total weed mass in spring wheat with legume crop was lower compared to that in the sole crop.

Ahmed *et al.* (2007), Ram *et al.* (2013) and Singh and Sidhu (2014), reported that mulch led to improvement in yield, soil quality, water use efficiency and profitability where as weed pressure was decreased in sustainable rice-wheat production system. Moore *et al.* (1994) reported that live cover crops had reduced the weed count and number of weed seedlings compared with the no cover crop treatment. Weed suppression by cover crop mulch system has been attributed to competition by the live cover crop and physical obstruction in weed emergence.

Kumar *et al.* (2010)observed that bed planting is low cost sustainable planting system, which helps crop to utilize solar radiation efficiently, saves water, reduce crop lodging and reduce population of herbicide resistant weed like *Phalaris minor*. Fahong *et al.* (2005) revealed that the grain yield of raised bed planting was at least 10 percent higher as compared to flat planting due to more and large grains per spike, reduction in weed biomass, disease and lodging.

Mahajan *et al.* (2000) reported significant decrease in dry matter accumulation by *Phalaris minor* and significant increase in grain yield of wheat by reducing row to row spacing from 22.5 cm to 15.0 cm. They reported that crops sown on beds approved more vigorous competition for weeds and enhanced seed yield. Dhaliwal *et al.* (2007) reported that closer spacing provided more suppressing effect on weeds, as the less space was available to weeds. Closer row spacing of 15 cm resulted in less population and dry matter of *Phalaris minor* as compared to normal spacing of 22.5 cm because of canopy coverage by wheat tiller over the weeds.

4. METHODS AND MATERIALS

The field experiment entitled "weed control in wheat through agronomic manipulations" was conducted at students' research farms, Khalsa College Amritsar during Rabi season of 2014-15. The experiment was planned to study the weed suppression ability in wheat through different agronomic manipulations. The experiment was laid out in randomized block design with ten treatments, having different combinations of planting methods, straw (paddy) and live (gram) mulch along with spacing replicated four times. The soil of the experiment field was sandy loam in texture with normal pH and electrical conductivity, low in organic carbon and available nitrogen and high in available phosphorus and potassium.

5. RESULTS AND DISCUSSION

Wheat is a premier food crop of India. It is second important staple food crop after rice. In conventional farming system fertilizers, insecticides, weedicides, pesticides form a major part of the cost of production. Further these synthetic chemicals are magnifying in our eco system. These are polluting our natural resources like soil and air. In addition to these, residual effect of these chemicals are also seen in our body. To get rid of these costlier and harmful substances, an alternative approach-producer technology is examined in which nutrients are applied through legume crops. Weeds are removed or suppressed by applying straw

mulching and water is saved by using bed planting method. The results of the experiment revealed that equal grain yield of wheat is obtained by manipulating the production system as compared to wheat productivity obtained under conventional system (35 quintal per hectare; statistical abstract of Punjab 2014). Further experimental results showed that grain yield of wheat was significantly improved by adding pulse crop (gram). Bed planting system of wheat establishment save 35 percent irrigation water as compared to conventional flat system which was generally followed by farmers. Other agronomic manipulations like closer sowing (four rows) and straw mulching produced significantly higher yield and benefit cost ratio. By addition of legume (gram) we can get high land equivalent yield.

Table 7.1.
Effect of different treatments on BC ratio

Treatments	*Benefit cost ratio*			
	Total cost	*Total income*	*Net profit*	*B:C*
T_1 Flat planting of wheat (C)	43775	78952	35177	1.80
T_2 Bed planting of wheat (C)	44025	85328	41303	1.93
T_3 Flat planting of wheat (WF)	47025	91780	44755	1.95
T_4 Bed planting of wheat (WF)	47275	96928	49653	2.05
T_5 Two rows of wheat (M + BP + WF)	48725	119025	70300	2.44
T_6 Two rows of wheat (M + BP + C)	45725	105053	59328	2.29
T_7 Three rows of wheat (M + BP + WF)	47975	121624	73649	2.53
T_8 Three rows of wheat (M + BP + C)	45725	104703	58978	2.28
T_9 Four rows of wheat (M + BP + WF)	46975	121740	74765	2.59
T_{10} Four rows of wheat (M + BP + C)	45725	104625	58900	2.28

C- no weed control,WF-weeds free, M-mulched, BP-bed planting.

Benefit cost ratio expresses the extent of benefit or profit earned by applying a particular treatment over its cost of cultivation. According to the data given in the Table 7.1 it has been observed that among different treatments maximum BC ratio was obtained with treatment 9 followed by treatment 7 and 5. Value of BC ratio observed with controlled flat planting remained lowest than all other treatments

Higher BC ratio observed under treatments whose crop planted in 2, 3 and 4 rows having straw and live (gram) mulch.. Higher BC ratio obtained in these treatments was due to gram intercrop. According to an estimate made by Directorate of Economics and Statistics for cost of cultivation of wheat in Punjab (GOI 2012) Rs. 4471 and Rs. 1468 per hectare were spent as a cost of fertilizers and manures and insecticides, respectively. These treatments saved costs leading to lower cost of production and hence better returns and benefit cost ratio.

The existing research procedures and political pressures are focused on short term productivity which ignored the long term environmental effects. i.e. It focused on the crop, field and at the best farm level. The long term effects on soil fertility, the regenerative capacity of natural fauna and flora and human health have not usually been given sufficient consideration. As again in case of Punjab, green revolution led to lot of environmental degradation in the form of burning paddy straw.These integrated techniques will help to reduce the cost of production and enhance the profits of the farmers.

Further the findings of this research project have made it very clear that farmers can make a shift from chemical led conventional farming to natural farming as it achieve goal of sustainability. This low cost farming produce quality food without any degradation to environment and soil.

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