



Analyzing the Profitability of Crop Rotation Patterns in Peshawar, Pakistan

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Authors' contributions

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ABSTRACT

A study was conducted in Khyber Pakhtunkhwa on comparison of six cropping patterns (CP1 to CP6). The study utilized the data that were used to find out the total cost of input-output from the six cropping patterns taken from the official record, of ARF, University of Agriculture Peshawar for the 2020-21 seasons. The objective of the study was to compare six different cropping patterns to determine the most profitable options for farmers in the region. Findings showed that the area allocated to berseem crop and berseem (2 cuts + seed) were 24 acres, where total input cost from berseem and berseem (2 cuts + seed) were Rs. 21,460 PKR and Rs. 21,220 PKR per acres, the total income from berseem and berseem (2 cuts + seed) were Rs. 69,000 PKR and Rs. 89,900 PKR per acres. The area allocated to oat crop and oats (1cuts + seed) were 18.5 acres, where total input cost from oat and oats (1cuts + seed) were Rs. 21,180 PKR per acres, the total income from oat and oats (1cuts + seed) were Rs. 45,500 PKR and 53,500 PKR per acres. The area allocated to wheat crop was 69 acres, where total input cost from wheat Rs. 29,450 PKR per acre, the total income from wheat Rs. 66,286 PKR per acre. The area allocated to brassica crop was 5 acres, where total input cost from brassica Rs. 25,950 PKR per acre, the total income from brassica Rs. 34,090 PKR per acres. The area allocated to maize (fodder) crop was 15 acres from CP2 and CP6, where total input cost from maize (fodder) Rs. 23,100 PKR from CP2 and Rs. 23,800 PKR from

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CP6 per acre, the total income from maize (fodder) Rs. 31,200 PKR per acres generated both from CP2 and CP6. The area allocated to maize (grain) crop was 16 acres, where total input cost from maize Rs. 26,056 PKR per acre, the total income from maize Rs. 32,900 PKR per acres generated from CP1, CP2 and CP5 and Rs. 32,830 PKR per acres generated from CP3, CP4 and CP6. The grand total income from CP1 and CP2 crops were Rs. 101,900 PKR and Rs. 109,600 PKR. The net income attained from CP1 and CP2 were Rs. 54,384 PKR and Rs. 39,264 PKR. The grand total income from CP3 and CP4 crops generated were Rs. 122,730 PKR and Rs. 86,330 PKR. The net income attained from CP3 and CP4 were Rs. 75,454 PKR and Rs. 39,094 PKR. The grand total income from CP5 and CP6 crops were Rs. 99,117 PKR and Rs. 98,120 PKR. The net income attained from CP5 and CP6 were Rs. 43,611 PKR and Rs. 21,614 PKR. The above results showed that CP1, CP3 and CP5 are the highest yielding and net income generating patterns than CP2, CP4 and CP6 overall the total income generated from CP3 was highest among all cropping patterns in Peshawar region. It was concluded that CP3= Berseem (2cuts + seed) --Maize (grain) was more remunerative followed by all other patterns and are highly recommended for sowing on vast area for the farmers in Peshawar region subject to high net income.

Keywords: Cropping patterns; input cost; net-income; outputs.

1. INTRODUCTION

Cropping pattern refers to the proportion of area under various crops at different points of time over space were grown in a particular locality or a zone or it indicates the yearly sequence and spatial arrangements of crops and fallows on a given area [1]. Changes in cropping patterns are changes in the proportion of land under particular crops or in the time and space sequence of crops. Cropping pattern obtaining in any particular agriculture area is generally the outcome of trials and adjustments in respect of farm enterprise, practices and is an important approach to assist the farmer in decision-making to remain sustainable in an ever-changing agricultural environment. A cropping pattern implies the extent of the region under different yields at a point of time. The yield measurements were utilized to signify trimming pattern [2]. It is part of the behavioral approach in geography because it reflects the performance of the farmer for various crops sown in an agricultural field [3]. It is also vital in determining the level of agricultural production and the agricultural economy of an area and may be affected by factors such as changes in agriculture policy, improvements in technology, and the availability of inputs [4]. There are different ways of growing crops that can be used to get maximum benefit. Most of the farmers adopt a particular cropping system in which they grow two or more crops to minimize the risk of total crop failure. Therefore, under the dynamic idea that no cropping pattern can be said to be ideal for all times to a specific area. It will change in space and time with requirements and is ruled largely by the physical as well technological and cultural factors. Mostly

the physical environment decreases the choice of certain crops. The choice of crops, the diversity of cropping, and the area under different crops also depend on soil conditions, temperatures and rainfall, crop price structures, labor availability, capital marketing, transport facilities, as well as terrain, topography, and slope [5]. Cropping systems need to be inherently flexible to take advantage of economic opportunities or adapt to environmental realities and it should integrate with full participation of the farmer to develop viable strategies and efficient and sustainable production systems [6]. To obtain maximum yield by farmers, typically, more than one crop is grown in succession on a single field each year in Pakistan, generally called "Multiple cropping," and when two or more crops are grown per season this is known as Double, Triple, or Quadruple cropping, depending on the frequency. Despite its intensity, farming in Pakistan is largely traditional or subsistence agriculture dominated by food grains. Variations in food grain cropping depend on water availability, landholding size, financial status, judgment, and farmers' capabilities. Farmers are most likely to adopt cropping patterns that raise their incomes from relatively limited land holdings [7]. Cropping pattern adopted by the farmer must be physically viable, sustainable, less exhaustive, and acceptable to the farming community and economical otherwise this leads to deterioration, low productivity, and ultimately lowers the income. In this regard, the cropping system should be restorative. The problems of price fluctuation, due to excessive use of pesticides and fertilizers and unemployment may be alleviated by changing of cropping system [8]. Similarly, the

List 1. Cropping Patterns

Cropping Pattern 1.	Berseem (fodder)	Maize (grain)	
Sowing time:	15th Oct	15th July	
Harvesting time:	1st July	15th Sep	
Cropping Pattern 2.	Oats (fodder)	Maize (fodder)	Maize (grain)
Sowing time:	15th Nov	10th May	15th July
Harvesting time:	1st May	10th July	15th Sept
Cropping Pattern 3.	Berseem (2cuts + Seed)	Maize (grain)	
Sowing time:	15th Oct	15th June	
Harvesting time:	1st July	15th Sept	
Cropping Pattern 4.	Oats (1cuts + Seed)	Maize (grain)	
Sowing time:	15th Nov	15th June	
Harvesting time:	1st May	15th Sept	
Cropping Pattern 5.	Wheat	Maize (grain)	
Sowing time:	15th Nov	15th June	
Harvesting time:	1st April	1st April	
Cropping Pattern 6.	Brassica	Maize (fodder)	Maize (grain)
Sowing time:	17th Sept	15th April	1st July
Harvesting time:	1st April	End of June	15th Oct

risk of low profitability, pest attack, and risks of aberrant weather may be reduced by introducing new crops in the cropping system [9]. The cropping system should increase farm productivity to achieve maximum water use efficiency and best utilization of farm labor, machinery, and other related resources [10]. Under optimum resources utilization and management, practices farmer profit cannot be maximized without optimum cropping pattern. To suggest a feasible pattern, the following six cropping patterns of the year 2018-19 were compared for net income in district Peshawar.

2. MATERIALS AND METHODS

2.1 Data Collection

The data was taken from the official record, of ARF, UAP during 2018-19 for the comparison of inputs and output cost of six different cropping patterns i.e. CP1= Berseem—Maize (grain), cropping pattern CP2= Oat—Maize (fodder)--Maize (grain), cropping pattern CP3= Berseem (2cuts + seed) ---Maize (grain), cropping pattern CP4= Oats (1cuts + seed) ---Maize (grain), cropping pattern CP5= Wheat---Maize (grain) and cropping pattern CP6= Brassica---Maize (fodder)---Maize (grain). These patterns were selected to evaluate the net income attained from CP1, CP2, CP3, CP4, CP5 and CP6. While inputs practices i.e. (land preparation, seed rate, fertilizer (DAP and Urea), abyana cost, weedicides, labour charges, thresher and cutting) were used and outputs i.e. (grain and fresh fodder) were obtained.

2.2 Input Costs

The input costs for the mentioned cropping patterns were determined to optimize output. Land preparation cost involved using a cultivator and rotavator for 2 hours per acre for each crop, calculated based on approved rates. Seed and fertilizer costs were calculated by determining the seed rate per acre for sowing and accounting for seed produced at harvest and reserved seed for the next season. Fertilizer costs (DAP/urea) per acre were documented. Abyana cost for different crops per season per acre was determined based on official crop rates from the Agronomy Research Farm. Weedicides cost per bottle was factored in for each crop per acre. Labor costs were assessed by employing four laborers for fodder and eight for grain crops throughout the entire season, with labor charges per day obtained from official farm records

2.3 Outputs

Each crop output i.e. as seed, grain, fresh fodder and other benefits to UAP in term of quantity, money grain per unit area was quantified for maximum outputs. After threshing, the grains were packed into 50 kg bags and sold in the market on approved rates. The total income for grain or seed crops was determined by dividing the total yield from the cultivated area by the total acreage. Fresh fodder played a significant role in income generation, and the incomes for fresh fodder from crops like berseem, oat, and maize were calculated by dividing the income from the total cultivated area by the total acreage. By-

products income was determined by multiplying the total straw area rate per acre. Output in terms of income, both total and per acre, was quantified, and conclusions were drawn based on the crops produced and other benefits for the growers. Possible aspects, such as omitting hoeing in wheat and brassica or eliminating spray in fodder maize, were explored to maximize the benefits of NDF improvement.

3. RESULTS AND DISCUSSION

3.1 Cropping Pattern 1: Berseem (fodder) --- Maize (grain)

3.1.1 Berseem

During the 2018-19 season, Berseem was cultivated on a total area of 24 acres, incurring an input cost of Rs. 21,460 PKR per acre (Table 1). The income generated from Berseem amounted to Rs. 69,000 PKR per acre. The grand total income for cropping pattern 1 (CP1) was Rs. 101,900 PKR (Table 2), with a net income of Rs. 54,384 PKR (Table 13). Various input practices were employed for Berseem cultivation, including two hours of labor for land preparation, costing Rs. 4,000 PKR for the use of a cultivator and Rs. 6,000 PKR for a rotavator. The recommended seed rate for Berseem was 12 kg, valued at Rs. 3,840 PKR. Additionally, 25 kg of DAP fertilizer, costing Rs. 2,000 PKR, and 70 kg of urea, valued at Rs. 2,520 PKR, were used. An Abyana cost of Rs. 300 PKR per season was incurred. Labor expenses during the entire Berseem season involved hiring four laborers for Rs. 700 PKR per day. The sale of fresh Berseem fodder contributed significantly to the income during the 2018-19 season. It is worth mentioning that the total input cost for CP1 Berseem was lower compared to maize, while the total output cost for CP1 Berseem was higher than maize.

3.1.2 Maize

Maize was cultivated over a total area of 16 acres, incurring an input cost of Rs. 26,056 PKR per acre (Table 1). The income generated from maize cultivation amounted to Rs. 32,900 PKR per acre. The grand total income for cropping pattern 1 (CP1) was Rs. 101,900 PKR (Table 2), resulting in a net income of Rs. 54,384 PKR (Table 13). Inputs included two hours of labor for land preparation, costing Rs. 4,000 PKR for the use of a cultivator and Rs. 6,000 PKR for a rotavator. 14 kg seed was purchased that valued at Rs. 896 PKR. Additionally, 37 kg of DAP fertilizer, costing Rs. 2,960 PKR, and 100 kg of

urea, valued at Rs. 3,600 PKR, were used. Weedicides, specifically S-mataclors and Chlorofiros, were sprayed on maize, incurring a cost of Rs. 2,750 PKR. An Abyana cost of Rs. 250 PKR per season was also associated with maize cultivation. Labor expenses during the entire maize season involved hiring eight laborers at a rate of Rs. 700 PKR per day. Significantly, income from the sale of maize grain constituted a substantial portion of the overall income during the 2018-19 season. Most important, the total input cost for CP1 maize exceeded that of berseem, while the total output cost for CP1 maize was lower than berseem.

3.2 Cropping Pattern 2: Oat (fodder) --- Maize (fodder)---Maize (grain)

3.2.1 Oat

In the 2018-19 season, oat was cultivated on 18.5 acres, with an input cost of Rs. 21,180 PKR per acre (Table 3). Oat yielded an income of Rs. 45,500 PKR per acre, contributing to a grand total income of Rs. 109,600 PKR in cropping pattern 2 (CP2), resulting in a net income of Rs. 39,264 PKR (Table 2). Input practices for oat included two hours of labor for land preparation, costing Rs. 4,000 PKR (cultivator) and Rs. 6,000 PKR (rotavator). The recommended seed rate was 35 kg at Rs. 3,500 PKR, with 37 kg of DAP fertilizer Rs. 2,960 PKR and 45 kg of urea Rs. 1,620 PKR. No weedicid spray was applied, but an Abyana cost of Rs. 300 PKR per season was incurred. Labor expenses involved hiring four laborers at a rate of Rs. 700 PKR per day. The income from sale of fresh oat fodder was a significant portion of the total income. The total input cost for CP2 oat was lower than maize (fodder) and maize (grain), while the total output cost was higher than maize (grain) and maize (fodder).

3.2.2 Maize (fodder + grain)

Maize was cultivated for fodder and grain on a total area of 15 and 16 acres. The input cost per acre for maize fodder + grain was Rs. 23,100 PKR and Rs. 26,056 PKR, with an income of Rs. 31,200 PKR and Rs. 32,900 PKR per acre, respectively (Table 3). The grand total income for cropping pattern 2 was Rs. 109,600 PKR (Table 4), resulting in a net income of Rs. 39,264 PKR (Table 13). Input practices for maize fodder + grain included two hours of labor for land preparation, costing Rs. 4,000 PKR (cultivator) and Rs. 6,000 PKR (rotavator). The recommended seed rate was 50 kg for fodder and 14 kg for grain, costing Rs. 3,200 PKR and

Rs. 896 PKR, respectively. Fertilizer recommendations were 40 kg of DAP for fodder and 37 kg for grain, with costs of Rs. 3,200 PKR and Rs. 2,960 PKR, respectively. Additionally, 100 kg of urea, costing Rs. 3,600 PKR, was used. Weedicides spray was recommended for maize grain, with S-mataclors and Chlorofiros costing Rs. 2,750 PKR. An Abyana cost of Rs. 300 PKR and Rs. 250 PKR per season was associated with maize fodder + grain. Labor expenses involved hiring four and eight laborers, costing Rs. 2,800 PKR and Rs. 5,600 PKR, respectively, for the entire season. Income from the sale of fresh maize fodder and maize grain constituted a significant portion of the total income. The total input cost for CP2 oat and maize (fodder) was lower than maize (grain), while the total output cost for CP2 oat was higher than maize (grain) and maize (fodder).

3.3 Cropping Pattern 3: Berseem (2cuts+seed) ---Maize (grain)

3.3.1 Berseem

In the 2018-19 season, berseem crop was cultivated over 24 acres with an input cost of Rs. 21,220 PKR per acre (Table 5). The income from the first two cuts of berseem crop amounted to Rs. 23,000 PKR, and by the end of the season, there was a yield of 223 kg of berseem seeds per acre valued at Rs. 66,900 PKR. The total income from berseem crop reached Rs. 89,900 PKR (Table 6). In the context of cropping pattern 3 (CP3), the grand total income was Rs. 122,730

PKR, resulting in a net income of Rs. 75,454 PKR for the mentioned year (Table 13). Input included two hours each of cultivator and rotavator use, costing Rs. 4,000 PKR and Rs. 6,000 PKR, respectively, for land preparation. The recommended seed rate for berseem was 12 kg, valued at Rs. 3,600 PKR. Additionally, 25 kg of DAP fertilizer, costing Rs. 2,000 PKR, and 70 kg of urea, valued at Rs. 2,520 PKR, were used. Moreover, weedicide was not applied for berseem crop. Total labour cost of Rs. 2,800 PKR was recorded for the entire berseem season.

3.3.2 Maize

The total area of maize was 16 acres and the total input cost of maize crop per acre during 2018-19 was Rs. 26,056 PKR (Table 5). The total income from maize crop was Rs. 32,830 PKR (Table 6). The grand total income from cropping pattern 3 was Rs. 122,730 PKR. The total net income from CP3 was Rs. 75,454 PKR (Table 13). All inputs practices were used i.e. the use of cultivator and rotavator (2 hrs) worth was Rs. 4,000 PKR and Rs. 6,000 PKR for land preparation, recommended seed 14 kg worth was Rs. 896. 37 PKR kg DAP worth was Rs. 2,960 PKR and 100 kg urea, worth Rs. 3,600 PKR. The weedicides S-mataclors and chlorofiros were used worth Rs. 2,750 PKR. The 2 labors at the time of sowing, 2 at the time of fertilizer application, 2 for irrigation time and 2 for cutting/harvesting were employed that costed Rs. 5,600 PKR

Table 1. Average cost of production per acre of Cropping Pattern 1 = (berseem (fodder)---maize (grain) at Agronomy Research Farm UAP during 2018-19

Practices	Inputs	Cost (Rs. PKR)	Berseem (fodder)	Maize (grain)
Land preparation	Cultivator (2 hrs.)	4,000	10,000	10,000
	Rotavator (2 hrs.)	6,000		
Seed rate	12 kg (Berseem F)	3,840	3,840	896
	14 kg (Maize G)	896		
DAP	25 kg (Berseem F)	2,000	2,000	2,960
	37 kg (Maize G)	2,960		
Urea	70 kg (Berseem F)	2,520	2,520	3,600
	100 kg (Maize G)	3,600		
Weedicide	S-mataclors (Maize G)	1,250	-----	2,750
	Chlorofiros (Maize G)	1,500		
Abyana cost	(Berseem F)	300	300	250
	(Maize G)	250		
Labour cost	4 labour (Berseem F)	2,800	2,800	5,600
	8 labour (Maize G)	5,600		
	Rs. 700 PKR Day ⁻¹			
Total cost			21,460	26,056

Table 2. Output of Cropping Pattern 1 = (berseem (fodder) ---- maize (grain) per acre at Agronomy Research Farm UAP during 2018-19

Crops	Production acre ⁻¹ (kg)	Total income (Rs. PKR)
Berseem (fodder)	-----	69,000
Maize (grain)	700	32,900
Total		101,900

Table 3. Average cost of production per acre of Cropping Pattern 2 = (oat (fodder)---maize (fodder)---maize (grain) at Agronomy Research Farm UAP during 2018-19

Practices	Inputs	Cost (Rs. PKR)	Oat (fodder)	Maize (fodder)	Maize (grain)
Land preparation	Cultivator (2 hrs.)	4,000	10,000	10,000	10,000
	Rotavator (2 hrs.)	6,000			
Seed rate	35 kg (Oat)	3,500	3,500	3,200	896
	50 kg (Maize F)	3,200			
	14 kg (Maize G)	896			
DAP	37 kg (Oat)	2,960	2,960	3,200	2,960
	40 kg (Maize F)	3,200			
	37 kg (Maize G)	2,960			
Urea	45 kg (Oat)	1,620	1,620	3,600	3,600
	100 kg (Maize F)	3,600			
	100 kg (Maize G)	3,600			
Weedicide	S-mataclors (Maize G)	1,250	-----	-----	2,750
	Chlorofiros (Maize G)	1,500			
Abyana cost	(Oat)	300	300	300	250
	(Maize F)	300			
	(Maize G)	250			
Labour cost	4 labour (Oat)	2,800	2,800	2,800	5,600
	4 labour (Maize F)	2,800			
	8 labour (Maize G)	5,600			
	Rs. 700 PKR Day ⁻¹				
Total cost			21,180	23,100	26,056

Table 4. Output of Cropping Pattern 2 = (oat (fodder)----maize (fodder)---maize (grain) per acre at Agronomy Research Farm UAP during 2018-19

Crops	Production acre ⁻¹ (kg)	Total income (Rs. PKR)
Oat (fodder)	-----	45,500
Maize (fodder)	-----	31,200
Maize (grain)	700	32,900
Total		109,600

3.4 Cropping Pattern 4: Oat (1cut+seed) - ----Maize (grain)

3.4.1 Oat

The total area of oat crop during 2018-19 was 18.5 acres. The total input costs of oat crop per acre during 2018-19 was Rs. 21,180 PKR (Table 7). The income from 1 cut of oat was Rs. 45,500 PKR and at the end of season yield of oat seed per acre was 80 kg worth was Rs. 8,000 PKR.

The total income from oat was Rs. 53,500 PKR (Table 8). The grand total income from cropping pattern 4 was Rs. 86,330 PKR. The net income during mentioned year from CP4 was Rs. 39,094 PKR (Table 13). All input practices were used i.e. the use of cultivator and rotavator (2 hrs) worth was Rs. 4,000 PKR and Rs. 6,000 PKR for land preparation, recommended seed rate 35 kg worth was Rs. 3,500 PKR. The recommended fertilizer @ 37 kg DAP worth was Rs. 2,960 PKR and 45 kg urea, worth was Rs. 1,620 PKR. There

was no use of weedicide for oat crop. The 2 labors were used at the time of sowing, 1 at the time of fertilizer application and 1 for irrigation time. The labor charges for oat crop for the entire season was Rs.2800 PKR.

3.4.2 Maize

The total area of maize crops during 2018-19 was 16 acres. The total input costs of maize crop per acre during 2018-19 was Rs. 26,056 PKR (Table 7). The total income from maize was Rs. 32,830 PKR (Table 8). The grand total income from cropping pattern 4 was Rs. 86,330 PKR. The net income during mentioned year from CP4 was Rs. 39,094 PKR (Table 13). All inputs practices were used i.e. the use of cultivator and rotavator (2 hrs) was worth Rs. 4,000 PKR and Rs. 6,000 PKR for land preparation, recommended seed 14 kg was worth Rs. 896 PKR. The recommended fertilizer @ 37 kg DAP worth was Rs. 2,960 PKR and 100 kg urea, costs were Rs. 3,600 PKR. There were use of S-mataclors and Chlorofiros weedicides worth Rs. 2,750 PKR. The 2 labors were used at the time of sowing, 2 at the time of fertilizer application, 2 for irrigation time and 2 for cutting/harvesting. The labor charges for maize crop for the entire season was Rs. 5,600 PKR.

3.5 Cropping Pattern 5: Wheat----- Maize (grain)

3.5.1 Wheat

The total area of wheat crop during 2018-19 was 69 acres. The total input cost of wheat during 2018-19 was Rs. 29,450 PKR per acre (Table 9). The total income of wheat was Rs. 66,286 PKR per acre. The grand total income from cropping pattern 5 was Rs. 99,117 PKR (Table 10). The net income of wheat during 2018-19 was Rs. 43,611 PKR (Table 13). Input practices that were used i.e. The use of cultivator and rotavator taken two hrs. worth Rs. 4,000 PKR and Rs. 6,000 PKR for land preparation, the recommended seed rate of wheat was 50 kg worth Rs. 2500 PKR. The recommended fertilizer i.e. DAP for wheat was 40 kg worth Rs. 3,200 PKR and urea for wheat was 100 kg worth Rs. 3,600 PKR. Weedicides Affinity spray were used for wheat costed Rs. 1,500 PKR. While Abyana cost for wheat per season worth Rs. 250 PKR. During wheat harvesting four labors were taken worth Rs. 2,800 PKR and two labor were taken for wheat straw worth Rs. 1400 PKR. In the entire season Rs. 700 PKR day⁻¹ was a charge

for labor. The total input cost of CP5 wheat was maximum than maize. The total output cost of CP5 wheat was maximum than maize.

3.5.2 Maize

The total area of maize was 16 acres and the total input cost of maize was Rs. 26,056 PKR per acre (Table 9). The total income of maize was Rs. 32,900 PKR per acre. The grand total income from cropping pattern 5 was Rs. 99,117 PKR (Table 10). The net income of maize during 2018-19 was Rs. 43,611 PKR (Table 13). Input practices that were used i.e. The use of cultivator and rotavator taken two hrs. worth Rs. 4,000 PKR and Rs. 6,000 PKR for land preparation, the recommended seed rate of maize was 14 kg worth Rs. 896 PKR. The recommended fertilizer i.e. DAP for maize was 37 kg worth Rs. 2,960 PKR and urea for maize was 100 kg worth Rs. 3,600 PKR. Weedicides, specifically S-mataclors and Chlorofiros, were used for maize at a cost of Rs. 2,750 PKR. These expenses, along with fertilizer and labor cost during harvesting, depleted resources. Abyana cost for maize per season amounted to Rs. 250 PKR, with eight labors hired during the entire season @ of Rs. 700 PKR day⁻¹. The income in 2018-19 was mainly from the sale of maize grain. It was clear that total input cost for CP5 maize was lower than wheat, as well as the total output cost for CP5 maize.

3.6 Cropping Pattern 6: Brassica-----Maize (fodder)-----Maize (grain)

3.6.1 Brassica

The total area of brassica crop area during 2018-19 was 5 acres. The total input cost of brassica during 2018-19 was Rs. 25,950 PKR per acre (Table 11). The total income of brassica was Rs. 34,090 PKR per acre. The grand total income from cropping pattern 6 was Rs. 98,120 PKR (Table 12). The net income of brassica was Rs. 8,140 PKR (Table 13). Input practices that were used i.e. The use of cultivator and rotavator taken two hrs. worth Rs. 4,000 PKR and Rs. 6,000 PKR for land preparation, the recommended seed rate of brassica was 6 kg worth Rs. 600 PKR. The recommended fertilizer i.e. DAP for brassica was 40 kg worth Rs. 3,200 PKR and urea for brassica was 100 kg worth Rs. 3,600 PKR. Herbicides spray was used for brassica costed Rs. 1250 PKR. While Abyana cost for brassica worth Rs. 300 PKR. Four labors

were taken worth Rs. 2,800 PKR for harvesting. In the entire season Rs. 700 PKR day⁻¹ was a charge for labor. The total input cost of CP6

brassica was minimum than maize (grain). The total output cost of CP6 brassica was maximum than maize (grain + fodder).

Table 5. Average cost of production per acre of Cropping Pattern 3= [berseem (2cuts+seed) ---maize(grain)] at Agronomy Research Farm UAP during 2018-19

Practice	Inputs	Cost (Rs. PKR)	Berseem (2cuts+seed)	Maize (grain)
Land preparation	Cultivator (2 hrs.)	4,000	10,000	10,000
	Rotavator (2 hrs.)	6,000		
Seed rate	12 kg (Berseem F)	3,600	3,600	896
	14 kg (Maize G)	896		
DAP	25 kg (Berseem F)	2,000	2,000	2,960
	37 kg (Maize G)	2,960		
Urea	70 kg (Berseem F)	2,520	2,520	3,600
	100 kg (Maize G)	3,600		
Weedicide	S-mataclors (Maize G)	1,250	-----	2,750
	Chlorofiros (Maize G)	1,500		
Abyana cost	(Berseem F)	300	300	250
	(Maize G)	250		
Labours cost	4 labours (Berseem F)	2,800	2,800	5,600
	8 labours (Maize G)	5,600		
	Rs.700 PKR Day ⁻¹			
Total cost			21,220	26,056

Table 6. Output of Cropping Pattern 3= [berseem (2cuts+seed) ---maize(grain)] per acre at Agronomy Research Farm UAP during 2018-19

Crops	Production acre ⁻¹ (kg)	Total (Rs. PKR)
Berseem (2 cuts)	23,000
Berseem (seed)	223	66,900
Maize (grain)	700	32,830
Total		122,730

Table 7. Average cost of production per acre of Cropping Pattern 4= [oat (1cut+seed) maize (grain)] at Agronomy Research Farm UAP during 2018-19

Practices	Inputs	Cost (Rs. PKR)	Oat (1cut+seed)	Maize (grain)
Land preparation	Cultivator (2 hrs.)	4,000	10,000	10,000
	Rotavator (2 hrs.)	6,000		
Seed rate	35 kg (Oat F)	3,500	3,500	896
	14 kg (Maize G)	896		
DAP	37 kg (Oat F)	2,960	2,960	2,960
	37 kg (Maize G)	2,960		
Urea	45 kg (Oat F)	1,620	1,620	3,600
	100 kg (Maize G)	3,600		
Weedicide	S-mataclors (Maize G)	1,250	-----	2,750
	Chlorofiros (Maize G)	1,500		
Abyana cost	(Oat F)	300	300	250
	(Maize G)	250		
Labours cost	4 labours (Oat F)	2,800	2,800	5,600
	8 labours (Maize G)	5,600		
	Rs. 700 PKR Day ⁻¹			
Total cost			21,180	26,056

Table 8. Output of Cropping Pattern 4= [oat (1cut+seed) ---maize (grain)] per acre at Agronomy Research Farm UAP during 2018-19

Crops	Production acre ⁻¹ (kg)	Total (Rs. PKR)
Oat (1 cut)	-----	45,500
Oat (seed)	80	8,000
Maize (grain)	700	32,830
Total		86,330

3.6.2 Maize (fodder + grain)

The total area allocated to maize (fodder + grain) was 15 and 16 acres while the total input cost of maize (fodder + grain) was Rs. 23,800 PKR and Rs 26,056 PKR per acre (Table 11). The total income of maize (fodder + grain) was Rs. 31,200 PKR and Rs. 32,830 PKR per acre whereas grand total income from CP6 was Rs. 98,120 PKR (Table 12). The net income of maize (fodder + grain) during 2018-19 was Rs. PKR 21,614 (Table 13). Input practices for maize (fodder + grain) included cultivator and rotavator for two hrs. each, with costs of Rs. 4,000 PKR and Rs. 6,000 PKR for land preparation. 50 kg seed for fodder and 14 kg for grain amount Rs. 3,200

PKR and Rs. 896 PKR, respectively. DAP fertilizer was applied at 40 kg for fodder and 37 kg for grain, costing Rs. 3,200 PKR and Rs. 2,960 PKR, respectively. Additionally, 100 kg of urea, valued at Rs. 3,600 PKR, was used. Weedicide spray was only applied for maize grain, involving S-mataclors and Chlorofiros at a cost of Rs. 2,750 PKR. Abyana cost per season for maize (fodder + grain) was Rs. 300 PKR and Rs. 250 PKR, respectively. Four and eight labour were taken worth Rs. 2,800 PKR and Rs. 5,600 PKR. Net income was mostly affected because it was not managed in respect to other crops. In maize (grain) resources were mostly exhausted by the weedicides in addition to the output cost of fertilizer and labor cost at time of harvesting.

Table 9. Average cost of production per acre of Cropping Pattern 5 = (wheat-maize) at Agronomy Research Farm UAP during 2018-19

Practices	Inputs	Cost (Rs. PKR)	Wheat	Maize (grain)
Land preparation	Cultivator (2 hrs.)	4,000	10,000	10,000
	Rotavator (2 hrs.)	6,000		
Seed rate	50 kg (wheat)	2,500	2,500	896
	14 kg (Maize G)	896		
DAP	40 kg (wheat)	3,200	3,200	2,960
	37 kg (Maize G)	2,960		
Urea	100 kg (wheat)	3,600	3,600	3,600
	100 kg (Maize G)	3,600		
Weedicide	S mataclors (Maize G)	1,250	1,500	2,750
	Chlorofiros (Maize G)	1,500		
	Affinity (wheat)	1,500		
Abyana cost	(wheat)	250	250	250
	(Maize G)	250		
Labours cost	4 labours (wheat)	2,800	4,200	5,600
	2 labours (wheat straw)	1,400		
	8 labours (Maize G)	5,600		
	Rs. 700 PKR Day ⁻¹			
Total cost			25,250	26,056

Table 10. Output of Cropping Pattern 5 = (wheat---maize (grain) per acre at Agronomy Research Farm UAP during 2018-19

Crops	Production acre ⁻¹ (kg)	Total income (Rs. PKR)
Wheat	850	66,287
Maize (grain)	700	32,830
Total		99,117

Table 11. Average cost of production per acre Cropping Pattern 6= (brassica-maize (fodder)--maize (grain) at Agronomy Research Farm UAP during 2018-19

Practices	Inputs	Cost (Rs. PKR)	Brassica	Maize (fodder)	Maize (grain)
Land preparation	Cultivator (2 hrs.)	4,000	10,000	10,000	10,000
	Rotavator (2 hrs.)	6,000			
Seed rate	6 kg (Brassica)	600	600	3,200	896
	50 kg (Maize F)	3,200			
	14 kg (Maize G)	896			
DAP	40 kg (Brassica)	3,200	3,200	3,200	2,960
	40 kg (Maize F)	3,200			
	37 kg (Maize G)	2,960			
Urea	100 kg (Brassica)	3,600	3,600	3,600	3,600
	100 kg (Maize F)	3,600			
	100 kg (Maize G)	3,600			
Weedicide	Perm (Brassica)	1,250	1,250	-----	2,750
	S-mataclors (Maize G)	1,250			
	Chlorofiros (Maize G)	1,500			
Abyana cost	(Brassica)	300	300	300	250
	(Maize F)	300			
	(Maize G)	250			
Labours cost	4 labours (Brassica)	2,800	2,800	2,800	5,600
	4 labours (Maize F)	2,800			
	8 labours (Maize G)	5,600			
	Rs. 700 PKR Day ⁻¹				
Total cost			21,750	23,100	26,056

Table 12. Output of Cropping Pattern 6 = (brassica---maize(fodder).... maize (grain) per acre at Agronomy Research Farm UAP during 2018-19

Crops	Production acre ⁻¹ (kg)	Total income (Rs. PKR)
Brassica	430	34,090
Maize (fodder)	-----	31,200
Maize (grain)	700	32,830
Total		98,120

Table 13. Net income from Cropping Patterns 1,2,3,4,5 and 6 per acre at Agronomy Research Farm UAP during 2018-19

Cropping Patterns	Output	Input	Net Income (Rs. PKR)
Cropping pattern 1	101,900	47,516	54,384
Cropping pattern 2	109,600	70,336	39,264
Cropping pattern 3	122,730	47,276	75,454
Cropping pattern 4	86,330	47,236	39,094
Cropping pattern 5	99,117	55,506	43,611
Cropping pattern 6	98,120	76,506	21,614
Total	617,797	344,376	273,421

4. CONCLUSION

The objective of this study has been achieved and it is concluded that cropping pattern 1 generated higher net income and highest yield compared to cropping pattern 2 same like cropping pattern 3 is more remunerative followed by cropping pattern 4 in case of high yield and profit while cropping pattern 5 was more profitable and high net income generating pattern compared to cropping pattern 6 in Peshawar region. So, CP1= Berseem (fodder) --- Maize (grain), CP3 = Berseem (2cuts+seed) ---Maize (grain) and CP5 = Wheat-----Maize (grain) are recommended as forage and grain for sowing on vast area for the farmers in Peshawar region on basis of high net income and marketing of the crops.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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