ECONOMICS OF *LALLEMANTIA ROYLEANA (TUKHAM-E-BALANGOO)* PRODUCTION IN THE LOW INTENSITY CROPPING ZONE OF THE PUNJAB, PAKISTAN

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ABSTRACT:- Unani medicine is part of Pakistani culture and is popularly practiced by a large segment of the population. This medicine system originated in Greece and was brought to the subcontinent by Muslim scholars. However, the unani medicine currently practiced in Pakistan is vastly different from its Greek roots. The study was conducted to assess the economics of medicinal crops in the low intensity cropping zone of Punjab. Therefore 80 respondents were taken from Karror Laal Eson and Layyah tehsil of Layyah in Punjab. Percent area allocated to *Lallemantia royleana* crop was comparatively higher at small farms as compared to medium and large farms. The study showed higher yield of *L. royleana* at large farms as compared to medium and small farms. Average gross revenue by small, medium and large farmers was Rs. 44175, Rs. 52483.02 and Rs. 55247.73 acre^{-1} respectively. Average net income by small, medium and large farmers was Rs. 25281.02, Rs. 28734.98 and Rs. 28763.83, respectively. Benefit cost ratio for small, medium and large farmers was 2.34:1.00, 2.21:1.00 and 2.09:1.00 respectively. Cultivation of *L. royleana* in Punjab is profitable enterprise. Because of low cost of production the profitability of *L. royleana* at small farms was higher as compared to other farm size categories.

Key Words: Medicinal Plant; Economics; Small Growers; Medium Growers; Large Growers; Pakistan.

INTRODUCTION

History of natural products is as old as human civilization. From ancient time, products from plants were the successful remedies due to their enhanced acceptability in human societies, better compatibility with the body and to treat different ailments due to their synergistic and/or side effects neutralizing combinations (Rates, 2001).

Medicinal plant knowledge has usually resulted from trial and error, and was based on speculation and superstition. Medicinal plants remain the prime source of primary health care throughout the world for thousands of years. However, in the middle of 20th century, the contribution of medicinal plants was reduced by approximately one fourth as researchers favored the use of synthetic chemicals for curing diseases. Now this trend is reversing in favor of medicinal plants as they contain natural products that are chemically balanced, effective and least injurious with none or much reduced side effects as compared to

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synthetic chemicals. Herbal medicine is thus experiencing a revival in Western society, along with other complementary therapies such as Traditional Chinese Medicine, Osteopathy, and Homeopathy. In general, people are becoming more aware of the harmful side effects of artificial commodities and are realizing the benefits of a more natural way of life (Hamayun et al., 2006).

It has been estimated that about 20,000 plant species are used for medicinal purposes throughout the world. In Pakistan it has been reported that 600 to 700 species are used for medicinal purposes (Asad et al., 2011). Medicinal plants have an impact in the society of developing countries, not only as a source of income (Shah et al., 2009) and also source of disease treatment for rural poor that is comparatively cheap. In Pakistan, 60% of the population, especially in villages is getting health care by traditional practitioners (Hakims), who prescribe herbal preparations (Haq, 1983).

The vernacular name of *Lallemantia royleana's* seed is Balangu or Balangu Shirazi (Naghibi et al., 2005) is belonging to the family of Labiatae. *Lallemantia* is represented by five species distributed in Afghanistan, China, India, Kazakhstan, Kyrgyzstan, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan, SW Asia, and Europe (Cao Shu, 1994). Lallemantia is growing extensively in different regions originally native to tropical Asia, throughout Afghanistan, Turkestan, India and Pakistan. This seed has small globular pone with white color in thin position and other terminal is convex with a notch (Razavi et al., 2008). Balangu is a good source of fiber, oil and protein and has medicinal, nutritional and human health properties (Naghibi et al., 2005). This natural herb is used for the treatment of arthritis, joint pain, rheumatism, osteoarthritis and abscesses inflammations. This seed absorb water quickly when soaked in water and produce a sticky, turbid and tasteless liquid. The genus Balangu seeds are used in a wide range of products made in traditional or industrial such as a beverage (namely *Tokhme Sharbati*) and bread in Iran and Turkey (Moghaddam et al., 2011).

Lallemantia royleana, with vernacular name of Balangu, is a mucilagenous endemic plant/crop which is widely grown in different regions of Pakistan viz., Layyah, Bhakkar, Bahawalpur, Hasilpur and Chishtian etc. Overall performance of *Tukhm-e-Balungoo* sown in the Baroun areas of Layyah was excellent and very much satisfactory due to the use of DAP fertilizer and timely rains in the Thal area (Aslam, 2007).

The medicinal plant species are considered to constitute an important group having significant role in crop diversification, poverty alleviation and sustenance of small farmers. Many reports available indicate the high economic returns through growing medicinal plants but all these relate to studies conducted at research stations.

The objective of this study was to investigate net income, benefit cost

ratio, gross margin and Cobb-Douglas production function to check Coefficient of regression model for *Lallemantia royleana* productivity.

MATERIALS AND METHOD

From medicinal crops, only *L. royleana* crop was targeted. A farm level survey was conducted in April 2011 in Layyah District. From Layyah, Karror Laal Eson and Layyah tehsils, *L. royleana* growers were selected purposively. From each tehsil, 40 *L. royleana* growers were selected as respondents. Thus, total 80 respondents were taken for the study. The data were collected through farmers' interviews using a well-structured questionnaire. The data were analyzed by using simple statistics to estimate the various responses and drawing conclusion for pertinent recommendations. The respondents were classified into small, medium and large farms according to size of their operational land holdings of less than 12.5 acres, between 12.5 acres and 25 acres and more than 25 acres, respectively.

Estimation of Costs and Incomes

Net value of the produced and cost involved were estimated. Cost of variables inputs such as labor, ploughing, planking, seed, fertilizer, irrigation, harvesting and threshing were computed. For the estimation of gross income, the value of product during the year was taken in to account. To compute the net income the following formula was used:

Net income (NI) = GR -TC

where,

NI = Net income
GR = Gross return
TC = Total cost

Benefit Cost Ratio (BCR) = GR / TC

It is defined as the amount received in the shape of profit on the costs of one rupee. The BCR was computed by this method.

BCR = GR/TC

where,

BCR = Benefit cost ratio
GR = Gross return
TC = Total cost

Gross Margin (GM) = GR - VC

where,

GM = Gross margin
GR = Gross return
VC = Variable cost

Empirical Model

The Cobb-Douglas production function is the most commonly used functional form for analyzing agricultural production data. The major reasons for using this functional form are due to its mathematical properties, simplicity of computation, and interpretation (Heady and Dillon, 1961). In addition, the Cobb-Douglas production function is relatively simpler to estimate because of logarithmic transformation into linear form (Beattie and Taylor, 1985). The empirical model of Cobb-Douglas production function given as,

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} + e^{Ui}$$

For the purpose of the present empirical exercise, the Cobb-Douglas production function was converted into the following logarithmic (Double log) form with variables specific as under:

$$InY = \beta_0 + \beta_1 ln(X_1) + \beta_2 ln(X_2) +$$

$\beta_3 \ln(X_3) + \beta_4 \ln(X_4) + Dweed + Dhoeing + u_i$

where,

Y = Yield of the *L. royleana* crop in maunds per acre.

β_0 = Constant term (intercept)

(X_1) = Number of land management practices,

(X_2) = Seed rate (kg acre^{-1}),

(X_3) = Numbers of irrigations,

(X_4) = Number of fertilizer,

Dweed = Dummy for weedicide use. It was taken as 1 for those using weedicide measures, else zero,

Dhoeing = Dummy for hoeing. It was taken as 1 for those using hoeing measures, else zero,

u_i = Disturbance term.

RESULTS AND DISCUSSION

Farm and Farmers' Characteristics

The average age of the respondents was about 43 years while the education level of the *L. royleana* grower was low in the study area and on average farmers had 8.1 years of regular schooling. The education level among small farmers was even low in the study area. The farmers of the study area were quite experienced in farming and on an average have 24.1 years farming experience. The small farmers were more experienced in farming as compared to other sample farmers in the study area.

The results revealed that majority (71.7 %) of the farmers were owner operated (Table 1) whereas about 20.8% of the farmer were owner-cum-tenant (Table 1).The tenant operated farms were not common in the study area.

Table 1. Socio-economic characteristics of the sample farmers by farm size

Characteristics	Small	Medium	Large	All
Age of farmer	48.30	42.9	37.30	43.2
Education of farmer	7.10	8.10	9.50	8.10
Farming experience of farmer	27.40	23.70	20.50	24.10
Tenancy status (%)				
Owner	80.00	70.40	63.60	71.70
Owner –cum- Tenant	20.00	18.50	27.30	20.80
Tenant	0.00	11.10	9.10	7.50
Power source (%)				
Own Tractor	6.67	48.15	63.64	39.50
Rented Tractor	93.33	51.85	36.36	60.50
Irrigation source (%)				
Tube well peter	80.00	59.26	63.64	66.00
Tube well tractor	0.00	11.11	18.18	9.20
Tube well peter+ Canal irrigation	20.00	29.63	18.18	24.50

Table 2. *Lallemantia royleana* acreage in the study area

Farm size category	Farm area (acres)	Total area (acres)	Percent farm area allocated to crop
Small	46.53	1.75	26.59
Medium	45.91	2.42	18.97
Large	64.33	7.22	8.91
Total	41.40	3.23	12.82

Tractor owned/rented was the only source of ploughing in the study area. More than 60 % of the farmers were using rented tractor while 66% of the farmers were using tube well peter as source of irrigation.

L. royleana Acreage in the Study Area

Overall percent area under *L. royleana* crop on small, medium and large farms was 1.75, 2.42 and 7.22 acres, respectively (Table 2).

The average area allocated to *L. royleana* crop by the respondents of the study area was 3.23 acres. The results of present study showed more area allocation to *L. royleana* crop by small farmers than other farm size categories in the study area. The present trend is more area allocation to *L. royleana* crop by small farms may be due to growing of *L. royleana* as traditional crop rather than commercial crop and change in crop rotation.

Cost of Inputs in the Study Area

L. royleana is an economical crop. Adequate quantity of inputs at proper time is very crucial for *L. royleana* crop. Accordingly much of the emphasis and its management practices along with its cost at farm levels were investigated in detail. Management of different inputs such as land preparation, seed rate, irrigations, fertilizer applications etc., not only increases the production and hence productivity and net returns could be increased without additional investment of resources. Expenditures on *L. royleana* irrigations were the same for all farm size categories because canal rates (abiana) are collected on per acre basis (Table 3).

Large farmers used more number of cultivators than small and medium *L. royleana* growers and the mean expenditures by large farmers were Rs. 1052.35 acre^{-1}. Similarly large farmers emphasized on planking and the mean expenditures were Rs. 252.10 acre^{-1}. The seed rate used by the medium farmers was more and higher than small and large farmers of *L. royleana* growers. Canal and Tractor tubewell irrigations were used by all farm size categories and the mean expenditures were Rs. 119.00, Rs. 171.19 and Rs. 243.00 of canal and Rs.2323.41, Rs. 2510.63 and Rs. 2543.88 of tube well peter irrigations used by small, medium and large farmers respectively. Medium and large farmers also used tractor tube wells for irrigations and the mean expenditures were Rs. 4084.63 and Rs. 5457.5 respectively. Use of DAP; urea and ammonium nitrate fertilizers was comparatively higher at the farm area as compared to other fertilizer by all the farmers of the study area. Expenditures on weedicides by small, medium and large farmers were Rs. 35.75, Rs. 32.82 and Rs. 36, respectively in the study area.

The manual harvesting charges for small, medium and large farmers

Table 3. Average quantity of inputs applied and expenditures of *L. royleana* crop

Item / unit	Application No.			Expenditure (Rs.)		
	Small	Medium	Large	Small	Medium	Large
Cultivator	1.93	1.92	2.18	876.22	824.06	1052.35
Planking	1.00	0.93	1.18	206.67	187.67	252.10
Rotavator	0.27	0.07	0.18	247.51	70.00	139.50
Disc ploughing	0.4	0.19	-	293.33	121.60	-
Leveling	0.47	0.56	1.18	227.17	301.60	655.56
Laser leveling	-	0.04	-	-	32.00	-
Seed rate (kg)	2.63	3.00	2.82	859.14	988.89	999.82
Canal irrigations	0.2	0.3	0.45	119.00	171.19	243.00
Tube well irrigations (No.) (Tractor)	-	4.33	5	-	4084.63	5457.5
Tube well irrigations (No.) (Peter)	3.93	3.75	3.44	2323.41	2510.63	2543.88
DAP (bags)	0.31	0.34	0.5	1006.12	1129.18	1516.25
Urea (bags)	0.69	0.85	0.77	649.59	821.22	764.44
AN (bags)	0.03	0.11	0.64	22.5	91.85	501.76
SSP (bags)	0.13	-	0.66	109.2	-	1333.33
NP (bags)	-	0.02	-	-	44	-
Zinc Sulphate (bags)	0.07	-	0.18	35	-	92.7
Weedicides (No.)	0.13	0.11	0.09	35.75	32.82	36
Weedicides labor Charges	-	-	-	150	150	150
Manual harvesting charges (Rs.)	1	1	1	1412.68	1746.84	1921.73
Threshing harvesting charges (Rs.)	1	1	1	5340	5122.22	4127.27
Land rent for one year	-	-	-	3250	3250	3250
Agriculture tax	-	-	-		150	250
Abiana	-	-	-	85	85	85

were Rs. 1412.68, Rs. 1746.84 and Rs. 1921.73 acre^{-1}, respectively. Low harvesting charges at small farms may be due to more use of family labor. The threshing charges of *L. royleana* crop for small, medium and large *L. royleana* growers were Rs. 5340, Rs. 5122.22 and Rs. 4127.27 acre^{-1}, respectively.

Economic Analysis of L. royleana Production

L. royleana yield on small, medium and large farms was 228, 262.8 and 265.6 kg acre^{-1}, respectively (Table 4). The results show comparatively higher yield of *L. royleana* at large and medium farms as compared to small farms. The higher yield may be due to better land preparation and more use of balanced fertilizer. Average gross revenue earned by small, medium and large farmers was Rs. 44175, Rs. 52483.02 and Rs. 55247.73 acre^{-1}, respectively.

Average net income by small, medium and large farmers was Rs. 25281.02, Rs. 28734.98 and Rs. 28763.83, respectively. In consistent to this study Ahmad(2005) conducted a study on "Introduction of medicinal herb and spices as crops (IMHSC)", the economics of cultivating *Plantago ovata* (Isphagol), *Lallemantia royleana* (Tukham-e-Balangoo), *Nigella sativa* (Kalongi), *Foeniculum vulgare* (Sounf), *Trachyspermum ammi* (Ajwain) and *Matricaria chammomilla* (Gul-e-Baboona) were assessed at farmer's field. He concluded that total income of Rs.17,500 from *N.sativa*, Rs.13,300 from *T. ammi*, Rs.16,000 from *L. royleana*, Rs.14,750 from P. *ovata* and Rs.16,800 from *F. vulgare* per acre was obtained. The variable cost of small, medium and large farmers was Rs. 15558.98, Rs. 20413.05 and Rs. 23148.90 respectively. The average total cost by small, medium and large farmers was Rs. 18893.98, Rs. 23748.05 and Rs. 26483.90 acre^{-1}, respectively. Benefit Cost Ratio for small, medium and large farmers was 2.34:1.00, 2.21:1.00 and 2.09:1.00 respectively. The study results clearly indicate that *L. royleana* production is pro-fitable enterprise in Layyah District. However, the cultivation was more profitable at small farms as compared to other farm size farmers. The main reason for higher profitability at small farms was lower variable cost. *L. royleana*

Table 4. Economic analysis of *Lallemantia royleana* production

Parameter	Small	Medium	Large
Yield (kg acre^{-1})	228.00	262.80	265.60
Gross revenue (Rs.)	44175.00	52483.02	55247.73
Variable Cost (Rs.)	15558.98	20413.05	23148.90
Total cost (Rs.)	18893.98	23748.05	26483.90
Gross margin (Rs.)	28616.02	32069.98	32098.83
Net income (Rs.)	25281.02	28734.98	28763.83
Benefit Cost ratio	2.34:1.00	2.21:1.00	2.09:1.00

Table 5: Coefficient of regression model for *Lallamentia royleana* productivity

Variables	Coefficients	Std. Error	t-value	Significance
(Constant)	1.266	.431	2.937	.005
Ln X_1	.024	.139	.169	.866
Ln X_2	.958	.141	6.801	.000
Ln X_3	-.644	.301	-2.137	.038
Ln X_4	.162	.083	1.942	.058
Hoeing	.394	.154	2.567	.014
Weedicide	.212	.141	1.503	.140
R^2	.640			
Adjusted R^2	.593			
F- Value	13.615			

production was a profitable enterprise in the *barani* area of Punjab.

$$InY = 1.266+0.024\ ln(X_1)+0.958\ ln(X_2)+0.644\ ln(X_3)+0.162\ ln(X_4)+0.212\ weed+0.394 hoeing+ui$$

In the regression analysis overall significance or goodness of fit of the model was determined by R^2 and f-test (Table 5). The value of R^2 is 0.640, which indicates that 64% variation in returns is explained by the model. The calculated F value is 13.61, which is significant at less than 1 percent level of significance. The results of R^2 and F test both indicate that model is correctly specified and all the variables included in the model are significantly explaining the variation in the independent variable that is returns from *L. royleana*.

The coefficient of total seed cost variable i.e. (X_2) had a value 0.958 with positive sign and was highly significant which reveals that one percent increase in seed rate use will highly effect the dependent variable means and returns increase by 0.958 percent.

The coefficient of total land management cost variable i.e. (X_1) had a value 0.024 with positive sign and was not statistically significant. It declares that one percent increase in land management cost will increase returns by 0.024 %.

The coefficient of total irrigation cost variable (X_3) showed significance its negative value may be due to over dose of irrigation by the farmers.

The coefficient of total fertilizer cost variable i.e. (X_4) had a value 0.162 with positive sign and was almost significant. It reveals that increase in fertilizer use will increase our dependent variable i.e yield of *L. royleana*.

The variables dummy for weedicide and hoeing have positive sign out of which weedicide was not statistically significant.

Recommendations

The large and medium farmers got higher yield as compared to small farmers. It is therefore

recommended that latest / improved production technology be disseminated in the area for increasing *L. royleana* yield at small farms.

- The *L. royleana* production being profitable enterprise in the Punjab. It is, therefore, recommended that its cultivation should be undertaken on widespread basis in the Punjab for increasing production and ultimately increment in foreign exchange by its export.
- The farmers reported the sharp increase in input prices while output prices remain same over the year. It is therefore recommended that the Government should effectively control the input prices to avoid the exploitation of farmers. There is problem in marketing of produce in the area; therefore, it should be resolved. Public efforts are urgently required to ensure timely disposal of *L. royleana* produce and prompt payment.

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