Journal of
Economics and Political Economy
www.kspjournals.org
Volume 9 December 2022 Issue 4

The effect of roses crops on households income in Afghanistan: Case study from Dari Noor district, Nangarhar Province

By Sardar Naeem HAKIMZAI †

Abstract. Afghanistan is an agricultural country, employing 85% of the population. Nangarhar province is the main source of food in Afghanistan. Most of the crops are grown and consumed in the different districts of the province. This study aims to examine the impact of rose crops on household income in Dari Noor district of Nangarhar province. For this study we are uded time series data from the period of 2015 to 2018. This is the first attempt to study the impact of rose crops on household income at the country level. Both quantitative and qualitative research designs were used in this study. A sample of 300 farmers was used for the study. Primary data were collected using well-structured and planned questionnaires. Secondary data were obtained from various official sources, including Afghanistan's Ministry of Agriculture, Irrigation and Livestock, the World Bank, German Agro Action (GAA), and the International Center for Agricultural Research in Dry Areas (ICARDA). The data was analyzed using inferential statistics such as the Heteroskedasticity test, Granger causality test, Multicollinearity test, multiple regressions, and descriptive statistics. The findings of the study revealed that rose cultivation starting time, the farmer's age, the farmer's education, the farmer's training, work experience, the number of employed males, rose yields, agricultural yields, and the government policies all had a significant effect on households income. Furthermore, the number of employed females has a positive but insignificant impact on household income. These findings suggest that the Afghan government should consider using the farmer's education, working age, farmer's training,and work experience as policy tools to increase household income from rose cultivation. By using the OLS estimation method, this study contributes to the literature in Afghanistan.
Keywords. Household income, Rose crops, Time series data, OLS, Afghanistan..
JEL. Q11, Q47.

1. Introduction

Agriculture is critical to the economic growth, progress, and development of emerging economies. Agricultural growth and productivity are considered critical for emerging economies to achieve their long-term growth and poverty reduction goals (Bautista, 1986). Historically, agriculture has been one of the most important sources of employment in developing countries. Afghanistan has been ravaged by war for the past four decades. During this time, regulatory, economic, social, and political institutions that ensure an efficient and effective investment environment have been destroyed. Fortunately, since the collapse of the Taliban regime and the new government adopted capitalism (free

† Department of Economics, Faculty of Economics, Nangarhar University, Nangarhar, Afghanistan.
☎. (410) 516-7183 ✉. sardarnaeem.hakimzai@gmail.com

market economy) in 2001, the government has begun to create and develop the institutional conditions required for investors to invest in Afghanistan. Insecurity and violence continue to prevail in Afghanistan, posing a long-term threat to livelihoods and economic activity. Nonetheless, Afghanistan is making greater progress in many sectors, including agriculture, than in the past. Afghanistan's economy expanded by about 2.3 percent. It is worth noting that agriculture has made a significant contribution to this economic growth. As previously stated, Afghanistan is an agricultural country, with agriculture directly and indirectly employing approximately 85 percent of the population. Agriculture (excluding opium poppy cultivation) accounts for roughly a quarter of total (GDP) in 2011, agriculture was the primary source of income for 49% of all households.

Development Alternatives, Inc (DAI) and the Provincial Reconstruction Team (PRT) were the major players in the province, but Relief International, MADERA, DACAAR, German Agro Action, the Swedish Committee, and others also contribute to the growth and development of the province's agricultural sector, particularly rose cultivation. Nangarhar province was previously the epicenter of poppy cultivation in Afghanistan, but the production was declined in 2005 due to the government's eradication program. Poppy, rice, maize, cotton, sunflower, beans, citrus, palm, potato, barley, wheat, mustard, sugarcane, and more recently rose cultivation are the main crops grown in Nangarhar province. Some agricultural products, such as roses, olives, and citrus fruits, have a distinct advantage in this province. Prior to the implementation of the rose project in Nangarhar province, many farmers were engaged in poppy/opium cultivation, and opium provided a significant portion of their income. Furthermore, government opponents benefited greatly from rose cultivation. Poppy/opium cultivation was widespread and the dominant crop in the 12 southern districts of Nangarhar province, as it was in other provinces of Afghanistan. At the beginning of 2001, the coordinator of foreign projects, particularly the cosmetics company WALA (Bad Boll), approached the Welthungerhilfe Afghanistan Desk in Bonn, Germany, and proposed the roses cultivation in Afghanistan, particularly in Nangarhar province, as an alternative to the increasing opium (poppy) cultivation. The Afghan government launched a large and widespread campaign against opium poppy cultivation under the slogan "Make perfume, not war." This was a good message for farmers in Nangarhar, who were thereby helped to quickly turn to grow roses instead of opium. Previously, no such research was conducted on the impact of rose crops on household income in Afghanistan. This is the first attempt at exploring the impact of rose crops on household income in Dari Noor district, Nangarhar province, Afghanistan. The study's findings can be used to assist the government, NGOs, and policymakers in making a strategy to promote the agricultural sector, specifically rose cultivation in Afghanistan. The general objectives of this study are as follows:

- To investigate the impact of rose crops on household income in Dari Noor district, Nangarhar province, Afghanistan.
- To examine the causal relationship between rose crops and household income.

In order to achieve the above research objectives, the following research questions were answered.

- What is the causal relationship between rose crops and household income?

- Does rose cultivation affect household income?

This paper is organized as follows: Section 2 summarizes the relevant agricultural literature. The next section presents the data sources and methodology. The statistical analysis is presented in section 4. Finally, Section 5 briefly discusses the main findings and assesses the policy implications.

2. Literature review

The agricultural sector is vital to the economies of both developed and developing countries. The agricultural sector is a critical component of the global economy. Moreover, it plays a number of roles in any country's economy, including food security, poverty reduction, the industrial revolution, and economic progress, particularly in emerging economies (Awan & Alam, 2015). Agriculture's economic importance can be viewed from three perspectives. 1) food for the nation and fiber for domestic industries; 2) foreign exchange instruments; and 3) provision of goods and services for domestic industries and the world market. According to Diao *et al.,* (2010), the majority of people in least developed and developing countries whose income and livelihood depend on agriculture are often poorer than those employed in other sectors of the economy. Overall, this is a large population group living in rural areas. Globally, poverty rates have gradually declined, largely due to economic growth and development. However, the question of what has led to economic growth and what is the role of the agricultural sector in poverty reduction has yet to be answered (Cervantes & Dewbre, 2010).

In recent decades, the global economic crisis has reduced demand for crops and flowers, especially in southern Europe. There are still greenhouses in these countries that use old growing and cultivation systems (Chamani *et al.,* 2005). Many of the fundamental drivers of emissions reductions, such as population and economic growth, fossil fuel availability, and advancements in low-carbon energy technologies, are inherently uncertain and are frequently accounted for using scenarios and situations (Nakicenovic *et al.,* 2000; Riahi *et al.,* 2016). The impact of ambiguity and uncertainty regarding long-term socioeconomic and technological progress on the integrated assessment of climate change mitigation options is thus a significant and critical issue (Matsuoka, 2000). The Rose study is the first to use baseline and extensuation methods to rheostatize these expectations and assumptions in a multi-model study to address this question in relation to economic growth and fossil resource expectations (Riahi *et al.,* 2016).

Rose demonstrated a model assessment and comparison of synchronized inequalities and changes in economic development, population, and fossil forms and assumptions in four interrelated evaluation models (Edmonds & Reilly 1985; Edmonds *et al.,* 1997). Flowers and cropping system, flowers and plants are planted in rows across the greenhouse in Rose's old farming and cropping system, and a tall green hedge is built to capture light for photosynthesis (Gonzalez-Real *et al.,* 2007). According to Memon & Shaikh (2000), commercial cultivation of rose petals has begun in recent years. Many of them are grown and cultivated in city districts (Memon, 2015). Commercial rose cultivation began in many countries, including Pakistan and Afghanistan, in the late 1970s (Khan, 2007). According to Steen (2010), flower production is an important part of trade and commercial greenhouse floriculture. An important component of commercial greenhouse floriculture is roses, which

account for about 25% of the flower business. The Dutch flower auctions in Aalsmeer, the Netherlands, are the world's most important market and trading place for flowers, where only the best plants and blooms are sold (Tsanakas & Voyiatzis, 2017).

According to Mosher & Turner (2000), roses have three types of shots: I flower shots, which bear a lethal flower(s) and are the commercially vital and significant parts of the plant, agricultural products, (ii) canopy shots, which form the photosynthetic awning and the structure of the plant - these shots bud from axillary shots on the primary shots and provide carbohydrates to the growing parts of the plant, and (iii) non-flowering unrea There is no commercial value to canopy sprouts (Zieslin *et al.,* 1973; Zieslin & Halevy, 1975). According to Johnston and Mellor, crop production plays an important role in economic growth and poverty reduction. Crop production can contribute to economic development through various channels, such as providing food and employment (Cuong, 2009). Afghanistan is an agricultural country with about 85% of the population being engaged in this sector. Agriculture accounts for nearly a quarter of the national GDP (excluding opium poppy cultivation). In 2011/12, the agricultural sector was the main source of income for 49% of all households (World Bank, 2014). Although the agricultural sector employs about 40% of the total labor force, not all of these workers are fully employed. Full-time equivalent jobs in the agricultural sector are estimated at 2.5 to 2.7 million, or 3.2 to 3.4 million if jobs are created through linkages between agriculture and the rest of the economy (Gollin, 2002). The Afghan economy remains primarily agricultural and, and it makes significant contributions to economic growth, job creation, poverty reduction, food security, and fiscal health (Fishstein & Paul, 2013).

Afghanistan has a long history of producing livestock and horticulture. Nonetheless, the last three decades of war have severely harmed the production structure, with agricultural output and productivity in the country being only half of what they were before the war. According to family-level data, a large amount of arable land is not exploited, owing to a lack of irrigation water. Fertilizers are used by only around 63% of farmers, insecticides, and herbicides by even fewer, and few farmers receive information or guidance on better farming practices or livestock management (World Bank, 2014). From a positive perspective, the challenges bid ample catch-up opportunities for productivity improvement. The agricultural sector's rapid growth requires greater investment in expanding irrigated land, improving irrigation water transmission and on-farm management, and developing services for information/knowledge provision and technology dissemination. According to simulations using a macroeconomic model, Afghanistan's GDP growth rate could be increased to 5.8% per year by increasing agricultural productivity (Mansfield & David, 2013). Nangarhar province is the food basket of the eastern zone in Afghanistan. Most crops are grown and consumed throughout the province. The majority of crops are grown and consumed across the province. The province's major summer crops are poppy, maize, rice, beans, potatoes, cotton, sunflower, citrus, palm, and, in recent years, rose crops. Winter crops include barley, wheat, potatoes, mustard, and sugarcane. Opium is the predominant and main crop in the 12 southern districts of Nangarhar province. There is a growing tendency of vegetables growing in the province due to their demand and high price. FAO, DAI, RI, German Agro Action (GAA), and ICARDA are the organizations

contributing to the promotion of the agricultural sector in Nangarhar province. Most of the vegetables and crops produced are supplied to Kabul and other parts of Afghanistan (Persaud, 2010). There is a large vegetable and fruit market in Jalalabad where most fruits and vegetables are sold. Grapes, oranges, apricots, persimmons, walnuts, plums, and guavas are among the most popular fruits grown in the Nangarhar province. The olives and oranges of Jalalabad are well known and consumed both locally and internationally. (GRM, 2004).

Roses in Nangarhar Province: In early 2001, the coordinator of the foreign projects, especially of the cosmetics company WALA (Bad Boll), approached the Welthungerhilfe Afghanistan Desk in Bonn, Germany, and suggested the cultivation of roses in Afghanistan, especially in Nangarhar Province, as an alternative to the increasing opium (poppy) cultivation. This request was based on the experience in Kerman, Iran, where households (farmers) had created a viable and sustainable livelihood by growing about 2,000 roses instead of opium (poppy). The idea was quickly taken up by Welthungerhilfe and turned into a viability and feasibility study (Langhans, 2005). Among the 10,000 recognized rose varieties, the damascene rose is the most multipurpose and the most awarded for oil production. It is widely and extensively cultivated as a medicinal plant and used internally and externally in a variety of applications as well as for perfume and beauty products (Ismail & Kabuga, 2016). The Afghan government launched a large and widespread campaign against opium poppy cultivation under the slogan "Make perfume, not war." It was a good message to farmers in Nangarhar, helping them to quickly turn to the cultivation of roses instead of opium (Chaon, 2018). The rose crops are used to make perfume called Orzala, which has a special market in Europe and America. In the past, rose water/oil was sent to France, Germany, and Canada for perfume making, but recently, fortunately, two companies have been established in Nangarhar province. one that extracts rose oil company from roses and one that produces perfume. The name of the company which makes perfume is called ORZLA."Roses for Nangarhar" has shown great perspective and potential for promoting the export of Afghan rose oil, creating jobs, and generating legal income for the rural population (Zariza, 2015).

3. Data and research method

This study used both primary and secondary data. The primary data was collected using a structured questionnaire to see the response of farmers/households against to rose yields. A questionnaire was used to collect primary data, which was filled out with the assistance of face-to-face interviews. The questionnaire was developed and designed in several steps. First, the initial format of the questionnaire was developed based on a review of the literature and other studies on the subject. In the second stage, the questionnaire was reviewed by experts and the validity of the questions was confirmed. The questionnaire was revised based on the experts' comments and advice. Subsequently, the questionnaire was translated into local language (Pashto) and distributed among surveyors, who used it to interview households. The secondary data was collected from different official sources such as the Ministry of Agriculture, Irrigation, and Livestock, the World Bank, German Agro Action (GAA), the International Center for Agricultural Research in Dry Areas (ICARDA), and other official reports published by

international organizations. The analysis of the impact of rose crops on household income in Nangarhar province focused on households engaged in rose cultivation. This population is given priority due to the penurious and needy of receiving empirical evidence in Nangarhar province. Thus, the population of this study were farmers from the Dari Noor district of Nangarhar province. The number of populations for this study was large, the respondents were chosen using a simple random sampling (SRS) technique. Although data collection may be completed and conducted on the entire population, this study only included 300 farmers out of 800 in the Dari Noor district.

The research design was basically quantitative in nature, but it was supported and strengthened by a degree of qualitative data. For this study, we have employed ordinary least squares (OLS) methods to estimate the impact of rose crops on household income in the Dari Noor district of Nangarhar, Afghanistan. The data analysis was conducted and displayed using the STATA application. The study model focuses on the factors affecting household incomes in Dari Noor district, Nangarhar province. This study has been used the following multiple linear regression model.

$$\begin{aligned}\text{LnHINC} &= \beta_0 + \beta_1\text{RST} + \beta_2\text{FAGE} + \beta_3\text{FEDUC} + \beta_4\ \text{FTR} + \beta_5\text{WEXP} + \beta_6\text{NEM} \\ &\quad + \beta_7\text{NEF} + \beta_8\text{LnROY} + \beta_9\text{LnAGYP} + \ \beta_{10}\text{GOVP} + \text{e}\end{aligned}$$

Dependent variable:
HHIC= household income
Independent Variables:
RCST = Rose cultivation starting time in years
FAGE= Farmers' age in years
FEDUC= Farmers' education in years
FT = Farmers' training in years
WEXP= work experience in years
NEM= number of employed males in rose cultivation
NEF= number of employed females in rose cultivation
ROY= rose yields in Afghani
AGYP= agricultural yields in Afghani
GOVP= government policies(government policy is measured by employment in the agriculture sector)

The hypothesis of the study

In this research, the hypothesis has been selected based on the literature review to explain the relations among those variables that affect or influence household income.

Null Hypothesis (Ho): rose cultivation starting time, farmers' age, farmers' education, farmers' training, work experience, number of employed males, number of employed females, rose yields, agricultural yields, and government policies do not effect (insignificant impact) on household income.

Alternative Hypothesis (H1): rose cultivation starting time, farmers' age, farmers' education, farmers' training, work experience, number of employed males, number of employed females, rose yields, agricultural yields, and government policies have an effect (significant impact) on household income.

4. The empirical analysis

4.1. Descriptive analysis

The descriptive statistics explain all questionnaires and data collected.

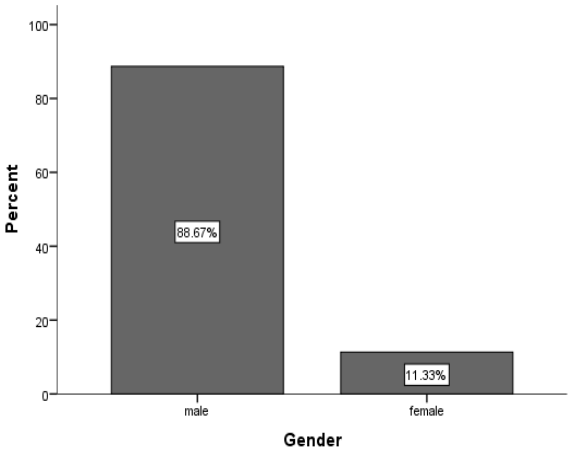

Fig 1. *Gender*

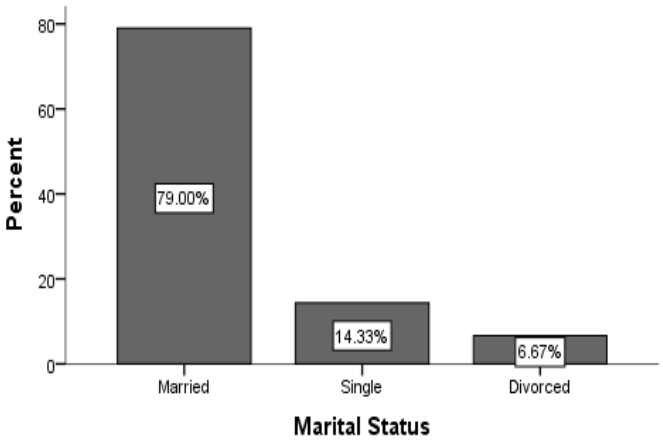

Fig 2. *Marital Status*

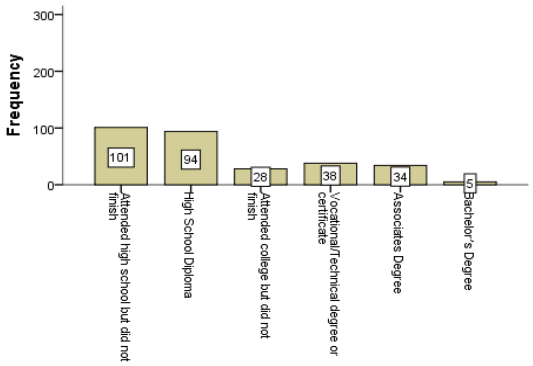

Fig 3. *Level of Education*

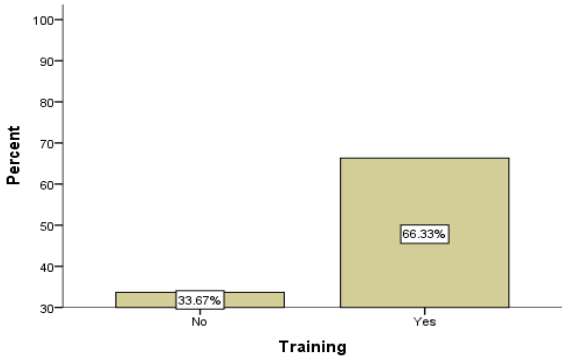

Fig 4. *Training*

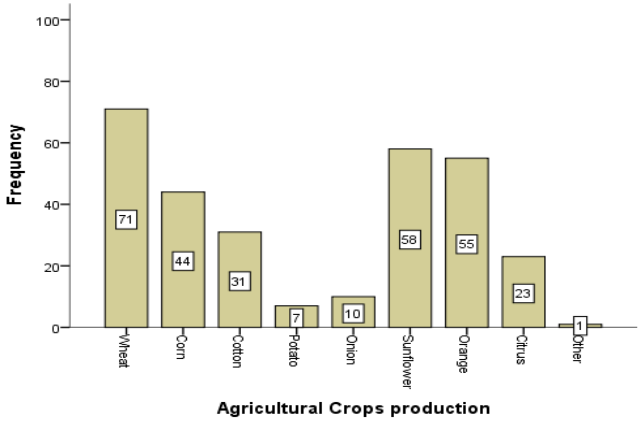

Fig 5. *Agriculture Crops*

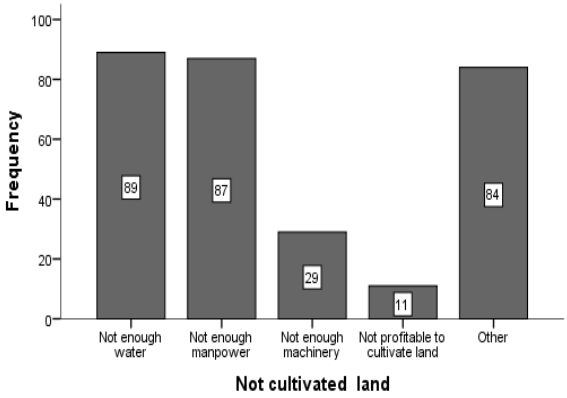

Fig 6. *No Cultivated Land*

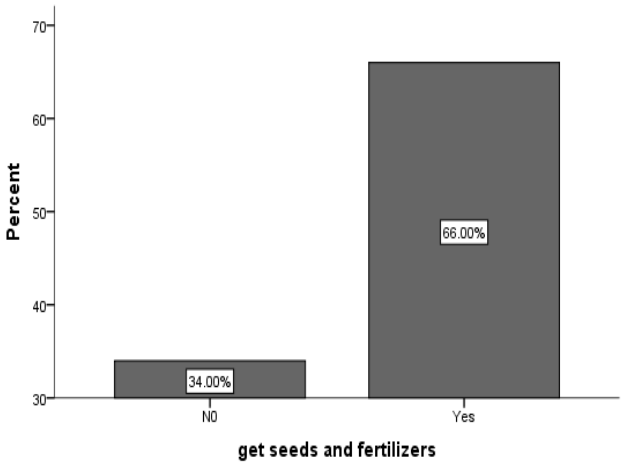

Fig 7. *Get Seeds and Fertilizers*

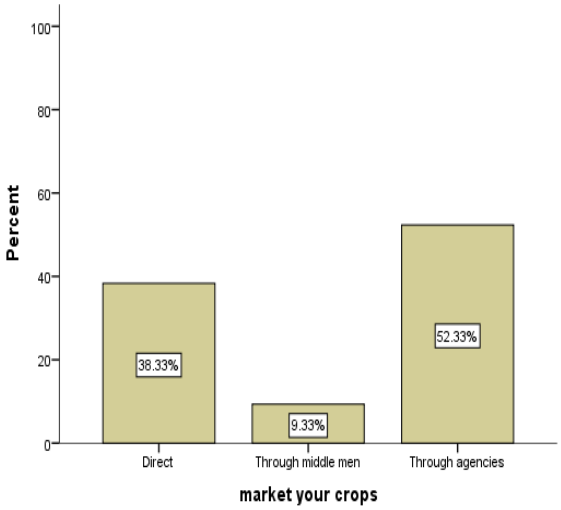

Fig 8. *Market Crops*

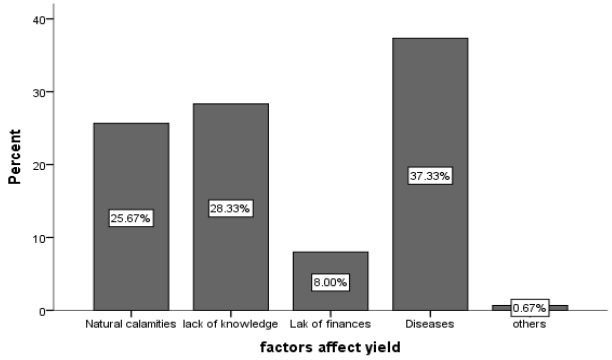

Fig 9. *Factors Affecting Agricultural Yield*

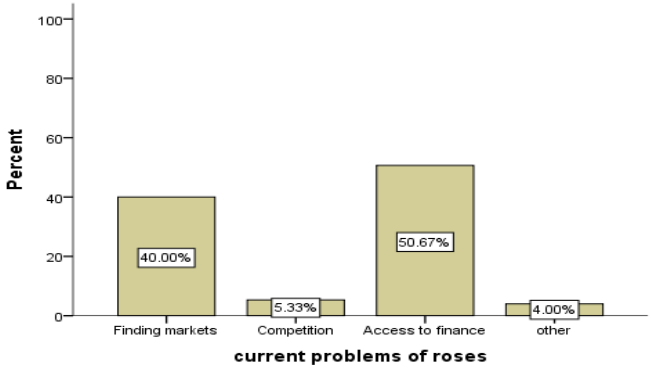

Fig 10. *Current Problems of Roses*

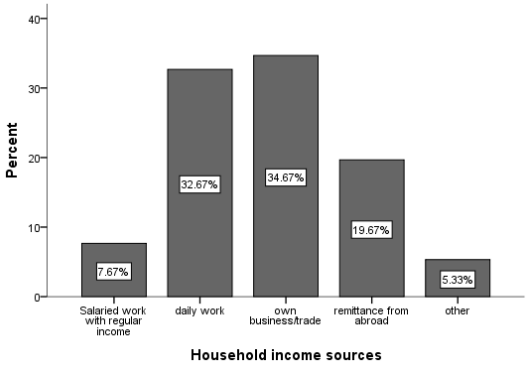

Fig 1. *Households' Income Sources*

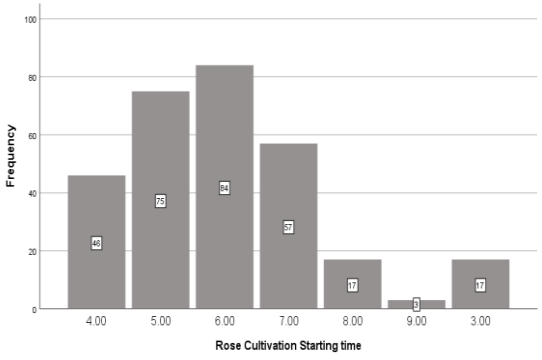

Fig 2. *Rose*

According to Fig.1 above, 88.67% of the males and 11.33% of the females are employed in rose production. Fig.2 shows that 79% of the farmers are married, 14.33% are single, and 6.67% are divorced. With respect to the education level in Fig.3, 101 of the farmers attended high school but did not finish, 94 had a high school diploma, 28 attended college but did not finish, 38 farmers had a vocational/technical degree certificate, 34 had an associate's degree, and 5 had a bachelor's degree. Fig.4 shows that the majority (66.33%) of respondents (farmers) received training, while 33.67% did not receive training. In Fig.5, out of the 300 respondents (farmers), 71 grew wheat, 44 grew corn, 31 grew cotton,

7 grew potato crops, 10 grew onion, 58 grew sunflowers, 55 grew oranges, 23 grew citrus with 1 farmer having grown other crops. Fig.6 indicates that, of the 300 respondents, 89 did not cultivate their land because there was not enough water for irrigation, 87 said there was not enough manpower, 29 said we do not have access to machinery, 11 believed it was not profitable to cultivate the land, and the remaining 84 said there was another reason why they did not cultivate their land.

According to Fig.7 above, 34 % of respondents never obtained seeds and fertilizers, while 66 % obtained seeds and fertilizers. Fig.8 shows that of the 300 respondents, 38.33% stated that most of our agricultural products are exported directly to the national markets. In contrast, 9.33% said that our agricultural products are transferred through middlemen to the market. In addition, 52.33% of the respondents said that crops are frequently transferred to markets through agencies. Fig.9 above, shows that out of the 300 respondents 25.6% responded that most of our agriculture products are affected by natural calamities. In contrast, 28.33% believed that lack of knowledge is one of the factors that affect our agricultural crops. Another factor that impacts our agricultural crops is lack of finance, according to 8% of respondents. 37.33% said that often our crops are impacted by diseases. In addition, 0.67% of respondents said that other factors affect our agricultural products.

Fig.10 shows that among the farmers surveyed, 40% reported finding markets to be a problem, while 5.33 % faced competition, 50.67 % faced access to funds, and 4% reported that other problems were present. Fig.11 shows that 7.67% of the households earned income from salaried work, 32.67% had an income from daily work, 34.67% had income from their own/private business, 19.67% had income from remittances from abroad, and finally, 5.33% had income from other sources. Fig.12 shows that out of the 300 respondents (farmers), 46 responded that they had been growing roses for 4 years, 75 indicated that they had been growing roses for 5 years, 84 of the respondents (farmers) indicated that they had been growing roses for 6 years, 57 farmers indicated, that they have started growing roses for 7 years, 17 respondents said they have been growing roses for 8 years, 3 farmers said they have been in the rose business for 9 years, and 17 indicated that they have been growing roses for 3 years.

4.2. Heteroskedasticity Test

A basic assumption of classical multiple linear regression models is that the error term variance is constant. If the error term variance is constant, the errors are homoscedastic. If the error term variance is not constant, the errors are heteroskedastic. A Brush-Pagan test checks the error term for heteroskedasticity.

Breusch-Pagan test for Heteroskedasticity

The Breusch-pagan test is used to determine whether the model has the problem of heteroskedasticity or not. The LM statistics for heteroskedasticity is the sample size times the R-square.

$$LM = N \times R^2$$

The LM statistics consider the p-value or table value. If the table value is less than the significance level, then the null hypothesis (Ho) of

homoscedasticity is rejected. This is the basic assumption of the Breusch Pagan test.

Table 1. *Heteroskedasticity Test: Breusch-Pagan*

F-statistic	0.904327	Prob. F(4,75)	0.4547
Obs*R-squared	3.681261	Prob. Chi-Square(4)	0.4312
Scaled explained SS	4.394141	Prob. Chi-Square(4)	0.3452

Source: *Questionnaire Administered*

The outcome of Breusch-Pagan is shown in Table 1. The $p-value=$ 0.4547 is more than 0.05 we, therefore, do not reject the null hypothesis (homoscedasticity) and the model has not had the problem of heteroskedasticity.

4.3. Multicollinearity Test

In a model, multicollinearity occurs when there is a correlation between explanatory variables (Greene, 2009). In other words, multicollinearity refers to the situation where one or more independent variables can be expressed as a combination of other independent variables. To test for multicollinearity, the Variance Inflation Factor (VIF) and the Pearson pairwise correlation matrix were used. According to Gujarati (2004), that any variable with a VIF greater than 10 indicates the presence of multicollinearity. A Pearson correlation coefficient of 0.5 or higher could indicate high collinearity. The results of this test in Table 2 indicated that there was no multicollinearity since no variable had a VIF greater than 10 or equal to 10.

Table 1. *Variance Inflation Factors (VIF)*

Variables	VIF
RCST	1.25
FAGE	2.03
FEDUC	1.32
FT	1.54
WEXP	1.44
NEM	1.54
NEF	1.66
ROY	1.47
AGYP	1.18
GOVP	1.27
HHIC	1.29

Source: *Questionnaire Administered*

4.4. Granger causality wald tests

The dynamic association is the most fundamental technique for investigating the cause and effect relationship between variables, and it is applied in the context of a simple linear regression model (SLRM). However, the simple linear regression model fails to arrest the causal and underlying dynamic causality between variables which is effectively analyzed by Granger (1969) in terms of the Granger causality tests.

Before employing the multivariate Granger causality test, make sure that all variables are stationary in levels. If no cointegrating vector exists, multivariate Granger causality tests are performed by first differencing the vector autoregressive (VAR) model.

Engle & Granger (1987) support this by arguing that if two-time series are cointegrated, they must be causally related. It is therefore critical to test for variable stationarity before running the Granger causality tests.

In this study, an empirical analysis of the long-run relationship between household income and rose yields is conducted in a VAR context. Johansen (1988) and Johansen & Juselius (1992) procedures and trials are used to estimate and test for long-run causal associations in the context of vector autoregression depiction of variables. We have run the following vector autoregressive (VAR) model:

$$LnHHIC_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i \, lnHHIC_{t-i} + \sum_{i=1}^{k} \alpha_i \, lnroses\ yields_{t-i} + u_{1t}$$

$$Lnroses\ yields_t = c_0 + \sum_{i=1}^{k} c_i \, lnHHIC_{t-i} + \sum_{i=1}^{k} f_i \, lnroses\ yields_{t-i} + u_{2t}$$

u_{1t} and u_{2t} are assumed to be uncorrelated. The number of lags, k, has been selected four by using the Schwarz information criteria.

In addition, The decision of selecting the VAR model with 4 lags {VAR(4)} has also been strengthened and supported by some diagnostic tests. Using the Augmented Dickey-Fuller test and the Johansen method, we verify that both series are integrated at the same order one, i.e. I(1), and are cointegrated. These outcomes are not considered here to save space and are available from the authors upon request. The VAR model with lags four is used for testing Granger causality by applying the F-test. We are obviously interested in the causal relationship between the two series of household income and rose yields.

Table 3. *Granger Causality Wald Tests*

Null Hypothesis (Ho)	F-test	Prob > F
LnHHIC does not Granger Cause LnROY	0.0003	0.0005
lnIROY does not Granger Cause LnHHIC	0.3552	0.0034

Source: *Questionnaire administered*

The F-test, as shown in Table 3, supports and interprets that lnHHIC and lnROY Granger are related and cause each other. The strength of causality from lnROY to lnHHIC is highly significant at all levels, whereas causality from lnHHIC to lnROY has been exposed to be rather significant. This means that the causal relationship between these two variables has a two-directional form, which in turn indicates that the relationship between rose yields and household income erraticness appears to be strong. The first research question in this study was: *"What is the causal relationship between rose crops and household income?" According to the estimated results reported in Table 3, rose yields and household income are related and cause each other.*

4.5. Result of regression analysis

Table 4. *Coefficients*

Dependent variable: lagged household income	Ordinary least-squares (OLS) model	
RCST	1.147 **	.000
	(0.223)	
FAGE	0.752 **	.000
	(0.103)	
FEDUC	0.041**	.001
	(0.006)	
FT	0.531 **	.011
	(0.231)	
WEXP	0.016**	.015
	(0.006)	
NEM	0.056*	.055
	(0.013)	
NEF	0.012	.873
	(0.076)	
lnROY	0.792 *	.051
	(0.385)	
LnAGYP	0.851**	.001
	(0.093)	
GOVP	0.061**	.021
	(0.043)	
Constant	8.195**	
	(1.575)	
F-statistics	28.463	
Prob > F	0.0000	
Observations	300	
R-squared	0.596	
Standard errors in parentheses		

Notes: *** p<0.01, ** p<0.05, * p<0.1
Source: *Questionnaire Administered*

The F-statistic is significant at a 5% level. The probability of its value (p-value = 0.000) is less than 0.05. Consequently, the overall model is significant. The R Square value of about 60% means that about 60% of the changes in household income are caused by changes in rose cultivation starting time, farmer's age, farmer's education, farmer training, work experience, number of employed males, number of employed females, rose yields, agricultural yields, and government policies. Therefore, the overall model accounts for 60% of the variance in the response variable (income) which is relatively efficient in practice. Table 4 shows the impact of rose crops on household income in the sample using the OLS estimation method. The estimated coefficient of rose cultivation commencement is significant and positively related to household income. A one- year increase in RCST leads to a 114.7% increase in household income. The coefficient value of the RCST is significant at the 5% level. The p-value (sig)= (0.000) < α=5%=0.05 significance levels. We, thus, reject the null hypothesis that the model is not significant in explaining the variations in household income. The implication of this outcome is that the rose cultivation starting time has significantly contributed to the household's income.

The coefficient value of Farmer age shows that there is a positive and significant correlation between rose crops and household income. One year increase in farmers' age leads to around a 75.2% increase in income. The coefficient of a farmer's age is significant at 5% significance level. The p-value

(sig)= (0.000) < α=5%=0.05. We, thus, reject the null hypothesis that the model is not significant in explaining the variations in household income. This result implies that the farmer's age has significantly contributed to the household income. The coefficient of farmer's education has a strong and positive effect on household income such that a one-year increase in farmer's education leads to a 4.1% increase in household income. The p-value (sig) = (.001) < α=5%=0.05. As a result, we reject the null hypothesis. The coefficient of farmer training has a significant and positive effect on household income. The p-value (sig) = (.01) < α=5%=0.05. We, therefore, reject the null hypothesis. The coefficient value of work experience indicates that there is a significant and positive relationship between rose crops and household income such that a one-year increase in a farmer's work experience leads to a 1.6% increase in household income. The p-value (sig) = (.015) < α=5%=0.05. We, thus, reject the null hypothesis that the model is ineffective at explaining the variations in household income. The number of employed males has a positive and significant effect on household income. İf the number of males increases by one, this leads to an increase in income of about 5.6%.

The coefficient for the number of employed males is significant at 10%. The p-value (sig)= (0.05) < α=10%=0.1. Thus, we reject the null hypothesis that the model cannot explain the variation in household income. The number of employed females has an insignificant but positive effect on household income. The p-value (sig) = (.873) > α=5%=0.05 significance level. Thus, we do not reject the null hypothesis. The estimated coefficient of rose yields is significant and positively correlated with household income. When rose yields increase by one percent, household income increases by 7.9%. The coefficient of rose yields is significant (at a 10% significance level). The p-value (sig)=(.05) < α=10%=0.1 significance level. Thus, we reject the null hypothesis. İf agricultural yields increase by one percent, household income increases by 85%. The coefficient of agricultural yields is significant at the 5% significance level. The p-value (sig)= (.001) < α=5%=0.05, rejecting the null hypothesis that the model cannot explain the variation in household income. Finally, the coefficient of government policy had a positive and significant effect on household income. The coefficient of government policy is significant at 5% level. The p-value (sig)=(.02) < α=5%=0.05. Therefore, we reject the null hypothesis that the model is not significant to explain the variations in household income. *The second research question in this study was "Do roses crops affect household income?" According to the estimated results reported in Table 4, rose yield had a significant effect on household income.*

5. Conclusion and policy implications

Crop production plays an important role in economic growth and poverty reduction and can contribute to economic development through various channels, such as providing food and employment. In recent decades, the global economic crisis has reduced demand for plants and flowers, especially in southern Europe. In these countries, there are still greenhouses based on old growing and cultivation systems. Afghanistan is an agricultural country where about 85% of the population is engaged in agriculture. Agriculture (excluding opium) accounts for nearly a quarter of GDP. Moreover, the agricultural sector is the most important source of income for 49 % of all households.

The agricultural sector employs about 40 % of the total labor force. Nangarhar province has an absolute advantage in some agricultural products, such as roses and citrus fruits. Nangarhar Province was once the center of poppy cultivation in Afghanistan, but according to government data, production declined in 2005 due to the government's eradication program. The Afghan government launched a big campaign against opium poppy cultivation under the slogan "Make perfume, not war." This research highlights the most important and good experiences of GAA's NGO GAA and points to an example of global society's assistance with the Afghan nation. This is the first attempt to study the impact of rose crops on household income in Dari Noor district, Nangarhar province, Afghanistan. The result of Breusch-Pagan test for heteroskedasticity shows that the model does not have the problem of heteroskedasticity. The strength of causality from lnROY to lnHHIC is highly significant at all levels, while the causality from lnHHIC to lnROY was found to be rather significant. According to the Granger causality Wald tests, the relationship between rose yield variation and household income variation appears to be strong. This study examined the impact of rose crops on household income in Dari Noor district, Nangarhar province of Afghanistan. An econometric model was used and estimated using the ordinary least squares (OLS) method to determine the relationship between the dependent variable (household income) and the independent variables (rose cultivation, starting time, farmer's age, farmer's education, farmer's training, work experience, number of employed males, number of employed females, rose yield, agricultural yield, and government policy).

The study found that rose yields were significant and positively correlated with household income. The coefficient of rose yields is significant at 10% significance level. The p-value (sig)= (.05) < α=10%=0.1 significance level. We, thus, reject the null hypothesis that the model is not significant in explaining the variations in household income. From a policy perspective, the government and policymakers should consider the farmer education, working age, farmer training, and work experience as policy tools to increase labor productivity and efficiency in the agriculture sector, especially in rose crops. Rose cultivation in the Achine and Spin Ghar districts of Nangarhar province, Afghanistan, remains unexplored due to a lack of time and financial resources. These were the main limitations for the researchers, and we hope that this research pave the way for future research.

References

Awan, A.G., & Alam, A. (2015). Impact of agriculture productivity on economic growth: A case study of Pakistan. *Industrial Engineering Letters*, 5(7), 27-29.

Bautista, R.M. (1986). Effects of increasing agricultural productivity in a multisectoral model for the Philippines. *Agricultural Economics*, 1(1), 67-85. doi. 10.1016/0169-5150(86)90007-1

Cervantes-Godoy, D., & Dewbre, J. (2010). Economic Importance of Agriculture for Poverty Reduction. *OECD Food, Agriculture and Fisheries Working Papers*, No.23. doi. 10.1787/5kmmv9s20944-en

Chabot, P., Dorosh, P.A. (2007). Wheat markets, food aid and food security in Afghanistan, *Food Policy*, 32(3), 334-353. doi. 10.1016/j.foodpol.2006.07.002

Chamani, E., Khalighi, A., Joyce, D.C., Irving, D.E., Zamani, Z.A., Mostofi, Y., & Kafi, M. (2005). Ethylene and anti-ethylene treatment effects on cut 'First Red' rose. *Journal of Applied Horticulture*, 7(1), 3-7. doi. 10.37855/jah.2005.v07i01.01

Chaon, A. (2018). Guns and roses: Afghan farmers enjoy the sweet smell of success. *Phys Org*, 23 July, 2021. [Retrieved from].

Cuong, N.V. (2021). Measuring the impact of cash crops on household expenditure and poverty in rural Viet Nam, *Asia-Pacific Development Journal,* 16(2), 87- 112. doi. 10.18356/e04e983e-en

Edmonds, J., Wise, M., Pitcher, H., ichels, R., Wigley, T., & Maccracken, C. (1997). An integrated assessment of climate change and the accelerated introduction of advanced energy technologies, *Mitigation and Adaptation Strategies for Global Change*, 1, 311-339. doi. 10.1007/BF00464886

Fishstein, P. (2013). *A Little Bit Poppy-free and a Little Bit Eradicated: Opium poppy cultivation in Balkh and Badakhshan provinces in 2011-12*. Afghanistan Research and Evaluation Unit. [Retrieved from].

Gollin, D., Parente, S.L., & Rogerson, R. (2002). The role of agriculture in development, *American Economic Review*, 92(2), 160-164. doi. 10.1257/000282802320189177

Gonzales-Real, M.M., A. Baille and R.P. Gutierrez-Colomer, 2007. Leaf photosynthetic properties and radiation profiles in a rose canopy (Rosa hybrida L.) with bent shoots. *Scientia Horticulturae*, 114(3), 177-187. doi. 10.1016/j.scienta.2007.06.007

GRM. (2021). *Provincial profile for Nangarhar*. Regional Rural Economic Regeneration Strategies (RRERS). [Retrieved from].

Ismail, A.A., & Kabuga, N.A. (2016). Impact of agricultural output on economic growth in Nigeria using ARDL Econometric approach, *Unpublished Manuscript*. [Retrieved from].

Jiang, K., Masui, T., Morita, T., & Matsuoka, Y. (2000) Long-term GHG emission scenarios of Asia-Pacific and the World. *Technological Forecasting and Social Change,* 63(2-3), 207-229. doi. 10.1016/S0040-1625(99)00110-9

Khan, M.A., & Younis, A. (2007). Phyto-chemical analysis and exploitation of hetrosis for essential oil contents in rose species. *M.Sc. Thesis Submitted in Institute of Horticultural Sciences*, Univ. Agric. Faisalabad.

Langhans, R.W. (2005). Timing, pruning and supporting. *In*: R.W. Langhans, (Ed.), *Roses: A Manual of Greenhouse Production*. (pp.65-70), Roses Inc: MI.

Mansfield, D. (2013). All bets are off! Prospects for (B)reaching agreements and drug control in Helmand and Nangarhar in the run up to transition. *Afghanistan Research and Evaluation Unit*, Kabul.

Memon, I.N. (2015). Performance of rose production in Sindh Pakistan. *Industrial Engineering Letters*, 5(7), 24-45.

Mellor, J.W. (1999). Faster, more equitable agricultural- the relation between growth in agriculture and poverty reduction, *Agricultural Policy Development Project Research Project Research Report*, No.4. [Retrieved from].

Nakicenovic, N., Alcamo, J., Davis, G., Riahi, K., Roehrl, R.A., Rogner, H.H., & Victor, H. (2000). *Special Report on Emissions Scenarios: A Special Report of Working Group III of the Intergovernmental Panel on Climate*. Cambridge University Press: Cambridge.

Persaud, S. (2010). Price volatility in Afghanistan's wheat market, *E-Outlook Report* No.WHS-10d-01. [Retrieved from].

Riahi, K., van Vuuren, D.P., Kriegler, E., & O'Neil, B. (2016). The Shared Socioeconomic Pathways: An Overview. Global Environmental Change. [Retrieved from].

Rostow, W.W. (1960). *The Stage of Economic Growth: A Non Communist Manifesto*, Cambridge University Press: London.

Susilastuti, D. (2018). Agricultural production and its implications on economic growth and poverty reduction. *European Research Studies Journal*, 21(1), 309-320. doi. 10.35808/ersj/949

Thorbecke, E., & Jung, H.S. (1996). A multiplier decomposition method to analyze poverty alleviation. *Journal of Development Economics*, 48(2), 27-300. doi. 10.1016/0304-3878(95)00037-2

Thirtle, C., Lin, L., & Piesse, J. (2003). The impact of research-led agricultural productivity growth on poverty reduction in Africa, Asia and Latin America, *World Development,* 31(2), 1959-1975. doi. 10.1016/j.worlddev.2003.07.001

Tsanakas, G.F., & Voyiatzis, D.G. (2017). Cultivating greenhouse cut roses with a bending system. *Journal of Applied Horticulture*, 17(3), 175-176. doi. 10.37855/jah.2017.v19i03.32

Zieslin, N., Halevy, A.H., Biran, I. (1973). Sources of variability in greenhouses rose flower production. Journal of the American Society for Horticultural Science, 98(4), 321-324. doi. 10.21273/JASHS.98.4.321