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Economic Analysis of Net Returns to
Opium Poppy, Wheat and Vegetables, Badakhshan, 2007

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Cover photo: NRM District Field Manager Sakhidad and leader of the Women's Unit Aisha Changaizi lead a special women's field day at the Faizabad Trial Farm. ADP/N used the field day to highlight new and improved agricultural techniques and show women new vegetable varieties introduced into Badakhshan by ADP/N.

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Primary Findings

- Most opium and wheat comparisons have used gross returns citing a ten to one ratio in favor of opium. Estimates of net returns in 2007 for Badakhshan reveal a much smaller advantage for opium poppy over wheat with a ratio of three (or even two) to one. While the calculation of net income, absent estimates of opportunity costs and economic benefits, is far from ideal, it provides greater nuance to the analysis than the off-cited comparison of gross income. This analysis supports the effort by ADP/N to popularize improved wheat seed and better fertilizer use.
- It is estimated that nine types of vegetables supported by the ADP/N Vegetable Enterprise Development Program – tomato, eggplant, onion, cucumber, carrot, turnip, cabbage, cauliflower and okra – provided a greater net return per hectare in 2007 in Badakhshan than did opium poppy production. These results were based upon moderate yield estimates. Further increases in productivity should result in even greater net returns. Market access such as market road improvement is a crucial factor in converting this productivity gain into an increase in profitability.
- The ADP/N 2007 Vegetable Enterprise Development Program added an estimated US\$ 3,428,000 to the regional economy in the form of the value of the incremental increase in vegetable production attributable to the program. This estimate does not include the nutritional benefits and economic value of vegetables home consumed by local farmers involved in this production. The total value of the vegetables produced by the program was US\$17,252,040.
- Growing vegetables increases potentially the returns to family labor and is competitive in terms of labor demand with opium poppy production. Increasing the returns to families' scarce resources (labor and capital) can drain away those resources from opium poppy production. Estimates indicate that the use of family labor in Badakhshan is similar for many types of vegetables to the labor demand for opium poppy. This will result in a closer focus by ADP/N on the family in vegetable program activities, for example, increased specialization of labor and greater use of intensive cultivation techniques.
- The institutional context affecting the cultivation decision needs to be addressed or at least better understood. These include, for example; water, irrigation and risk management; access to land and sharecropping, and; access to credit and debt management. Credit is an important factor in determining crop selection planting decisions. Credit and investment remains very low in Badakhshan. In order for farmers or farmer groups to engage in value added processing and marketing, flexible credit will need to be a part of the available programs.

Executive Summary

The goals for this research were to:

- Develop data that estimates and permits comparison of net income for selected vegetable crops and wheat with opium poppy production on a per hectare basis;
- Estimate the net income per hectare from the adoption of improved seed and technology packages, and;
- Estimate the regional economic effects for adoption of improved seed and technology packages supported by ADP/N.

An initial literature review, the first section of this report, revealed discord among experts in the field in the choice of analytic focus of this research. The dissenters argue convincingly for a broader set of issues than calculations of returns per hectare for various crops. To respond to the critique that a broader decision making framework determines cultivation of opium poppy, wheat and vegetables, this analysis briefly reviews the role of food security; water, irrigation and risk management; access to credit and debt management, access to land and sharecropping, and; the role of hired and family labor.



During a Field Day in Faizabad, ADP/N agriculture experts show farmers rain-fed wheat grown using modern practices.

The next section of this report explains the use of unit activity analysis, especially partial budgeting, to examine one activity or decision, in this case calculating and comparing the net income from cultivating opium poppy, wheat and vegetable crops. The limitations of partial budgeting are mentioned. Whole farm budgeting is presented as the best tool for analysis to address the trade-offs faced by the farm household. Despite the preferences and cautions of the experts for use of more comprehensive frameworks and analytic tools, it is argued here that the role of markets and calculations of net returns play a part, though perhaps not the most important, in producer cultivation decisions.

For opium poppy, wheat and eleven types of vegetables this analysis estimates net income per hectare by examination of: data sources; yield estimates; price estimates; seed and fertilizer costs; hired and family labor use and costs; other income, and; other costs.

Opium poppy production in Northeastern Afghanistan has fluctuated significantly over the last four years. Prices have also fluctuated, but possibly not to the same degree. The complex and insidious role of opium in gaining access to credit, land and employment explains and reinforces

the apparent lack of relative price response. When opium poppy prices decline to the low levels reported recently in Badakhshan, other crops become more competitive, especially intensive crops such as vegetables, but also wheat, due to higher prices and the economic value of straw.

Given the costs in hired labor associated with achieving good opium poppy yields, there is a sizeable reduction in net revenue compared to wheat and vegetables. There remains a potential increase in opium poppy prices which will improve its competitive position. However, the high variable costs associated with the use of hired labor in opium poppy production significantly reduces the ratio of gross income compared to net income of opium poppy to wheat and vegetables. Net income estimates for opium ranged between US\$ 2,100/ha. and US\$ 940/ha. depending on yield and price assumptions.

Cultivating wheat is primarily a food security decision. Wheat, like opium, is considered less responsive to price signals. This is because wheat is a basic grain. But wheat prices have also been increasing, making the relative competitiveness of wheat versus opium poppy much improved. Average wheat yields produce a net income of US\$ 650/ha. compared to average opium poppy net income of US\$ 1,275/ha. Using the United Nations Office on Drugs and Crime (UNODC) production and price estimates, a good net return of US\$ 2,183/ha. on opium poppy is possible. When factoring in the on-farm use and



Farmers near Baharak who received seed kits through ADP/N tend to their potato field. Farmers who received improved seeds reported that their potatoes were in high demand from merchants.

potential returns of wheat straw, the competitive position further improves. Wheat will not likely compete with opium poppy purely considering net income. However, opium poppy and wheat net income, while still showing higher returns to opium poppy production, indicates that the gross income ratio of ten to one is reduced to three (or even less than two) to one. Further reductions can be expected with use of improved seed varieties resulting in increased productivity. A major cost difference is the almost exclusive use of family labor with less overall labor required in wheat production versus opium poppy production. However, opium poppy provides greater opportunities for hired labor, permitting those employed to increase their food security by purchasing wheat.

Growing vegetables is not only a food security decision but also represents an income diversification opportunity for the farmer. The net returns to the moderate yields reported by the ADP/N vegetable survey shows the market potential and relative productivity and profitability of almost all of the vegetables supported by ADP/N. Nine of eleven vegetable crops exceed the average opium net returns and six types of vegetables exceed the higher production and price

opium poppy estimates. As ADP/N addresses issues of market access and regional economic development, the market potential for vegetables can be realized. The robustness of the net income comparison between opium poppy and vegetables is supported by calculation of the incremental income per hectare for vegetables, given the yields and yield increase estimates. There is a wide range from US\$ 194/ha increase in income for pepper to US\$ 1,007/ha. increase in income for onion.

We have also calculated estimates of US\$ 3,428,000 for the value of incremental yields and US\$ 17,252,040 for the value of total production in Badakhshan resulting from the ADP/N Vegetable Enterprise Development Program. Such estimates will provide benchmarks for comparisons of improvements in productivity and profitability.

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Abbreviations and Acronyms

ADP/N	Alternative Development Program/Northeastern Afghanistan
AREU	Afghanistan Research and Evaluation Unit
FEWS NET	Famine Early Warning Systems Network
FAO	United Nations Food and Agriculture Organization
MAIL	Afghanistan Ministry of Agriculture, Irrigation and Livestock
MCN	Afghanistan Ministry of Counter Narcotics
PAL	Project for Alternative Livelihoods
RAMP	Rebuilding Agricultural Markets Program
TTC	Technology Transfer Centers
UNODC	United Nations Office on Drugs and Crime
USAID	United States Agency for International Development

Introduction

There are three objectives addressed in this report:

- Develop data that estimates and permits comparison of net income for selected vegetable crops and wheat with opium poppy production on a per hectare basis;
- Estimate the net income per hectare from the adoption of improved seed and technology packages, and;
- Estimate the regional economic effects for adoption of improved seed and technology packages.

Six sections to this report respond to these objectives.

1. A Framework for Cultivation Decisions

This section discusses other points of view about the approach taken in this research. Subsections briefly discuss: food security; water, irrigation and risk management; access to credit and debt management; access to land and sharecropping, and; the role of hired and family labor.

2. Partial Budgeting

This section discusses unit activity budgets and partial budgeting. The uses and limitations of these approaches and calculations are discussed along with the need to estimate or at least consider opportunity costs. Important assumptions, for example, the utility of before and after comparisons of yields, are reviewed

3. Opium Poppy Net Income Estimates

Using UNODC opium production data and ADP/N staff estimates of production and costs, this section identifies the salient role of prices and high levels of hired and family labor use and cost in determining net income for opium poppy production.

4. Wheat Net Income Estimates

The estimates of net income for irrigated and rain-fed wheat in this section use Afghanistan Ministry of Agriculture, Irrigation and Livestock (MAIL) data and ADP/N staff cost estimates. The results reveal a better comparative position for wheat using net income than when using comparisons of gross income. Food security and high prices for wheat are also discussed

5. Vegetables Net Income Estimates

In this section the ADP/N Fall 2007 vegetable survey yield and price data are combined with ADP/N staff cost estimates to calculate net returns for eleven kinds of vegetables. The results reveal significant competitive potential, using net income calculations, of vegetables with opium poppy. Vegetable production also has substantial potential for use of hired labor and intensive use of family labor.

6. Summary Analysis

This final section compares partial budgets for opium poppy, wheat and vegetables by discussing price responsiveness, cost of seed and fertilizer, hired and family labor and net income. The incremental returns to the use of improved vegetable seed as well as the regional incremental and total economic effects are also presented.

1. A Framework for Cultivation Decisions

Cautions

The framework or context for production decisions involving opium poppy is more complex than estimating yields, prices and costs of opium poppy and wheat and vegetables. A selective review of the literature revealed contention around the role of prices and gross income as a determinant of opium poppy cultivation decisions.

According to David Mansfield of the Afghanistan Research and Evaluation Unit (AREU): “Within the drug control community there has been in the past a tendency to see Afghanistan in the context of “opium growing households” and non-opium growing households.” Too often this analysis focuses on estimates of the economic returns on opium poppy per unit of land. In this context, drug control analysts and commentators typically refer to the gross returns per hectare from opium poppy cultivation. In turn, these aggregate figures are often compared with the economic returns on wheat, and reference is made to significantly higher profitability derived from opium cultivation.

Typically, this kind of analysis does not place opium within the context of the wider household economy and rural livelihoods strategies. It does not take into account different rural actors involved in opium poppy cultivation and how the aggregate economic returns for a unit of land are distributed among them; how these returns vary considerably depending on different inputs that each group contributes to opium production; and how the final return on their input will be a function of the other assets at the disposal of each of these different actors. Perhaps most important of all, the analysis focuses primarily on the potential on-farm income that might be derived from opium poppy cultivation



Mohammad Kareem, a farmer in Jata village outside Faizabad, shows off potatoes grown using seed supplied by ADP/N. Kareem happily noted that the potatoes were prized by local merchants and produced twice as well as domestic varieties.

and neglects the other assets that households gain access to through their engagement in opium poppy cultivation.” (2006, pgs 54-55)

Drawing heavily upon the research of AREU, especially the work of David Mansfield and Adam Pain, the following elements of the decision making framework affecting opium poppy and some of its alternatives are discussed here:

- Food Security
- Water, Irrigation and Risk Management
- Credit and Debt Management
- Access to Land and Sharecropping
- Hired and Family Labor

The analysis in this report takes a firm stand in the middle on the issue of the importance of net returns. It recognizes the context of production decisions but asserts that yields, prices, costs and net income are important factors in that context and thus provides a more detailed view than analysis based solely on gross returns and alternative crops. This report presents a modest change in perspective.

Food Security

Opium poppy, wheat and vegetable cultivation support, in different ways, food security. The income provided by opium poppy cultivation allows those who gain or are employed directly and indirectly to purchase food. Wheat is a basic grain that can provide cash income but is primarily consumed by the agricultural household. Similarly, vegetables provide for food security through home consumption and, as a cash crop, market sales. Some crops can compete in terms of financial returns with opium poppy when opium prices are low; none offer the same qualitative attributes, including: relative drought resistance; a non perishable product; an income source to provide food security; an almost guaranteed market; and traders who offer advance payments against the future crop. (Mansfield. 2006. pg 61) Cultivation of wheat and vegetables, however, can directly provide food security and do not need to be financially competitive with opium poppy.

Water, Irrigation and Risk Management

Research has indicated that during drought years, households determined how much land to dedicate to wheat based on estimates of water availability. (Mansfield. 2006) For agricultural crops, weather conditions have an impact on yields and hence on overall supply and commodity prices. It is an important element in the risk calculus made by the farmer.

Irrigation water is rationed and seldom priced. It is distributed by volume or time use by a traditional community management system that often favors larger farmers. Opium poppy maximizes the returns of scarce irrigation water by using less than irrigated wheat and vegetables. Because it is more drought resistant and uses less irrigation water, it is a lower risk crop. Opium poppy also offers a better return per unit of water. Agricultural households will favor wheat cultivation if they fear that they will not be able to purchase wheat in the market due

to cost or lack of availability. Cultivation of other crops may be limited. Vegetables and fruits as well as wheat are vulnerable to crop failure as a result of water shortages and the inability to capture full value because of poor transportation. (Mansfield. 2006. pg 62)

Access to Credit and Debt Management

Opium poppy is a high-value, low volume commodity with generally high market demand. The traditional credit system (where advance payments are made on future crops) favor opium poppy cultivation. Availability of some kinds of traditional credit is dependent on the willingness of the farmer to cultivate opium poppy. Salaam, a traditional source of credit from traders, sometimes includes advance payments on other agricultural products, such as wheat, but opium is the crop favored by lenders. Debt and hired labor is often paid in-kind with opium. Most credit for opium comes from traders. However, the cost of the credit from traders is high. Those who have to borrow, poor farmers and rural wage laborers, are often mired in debt (Byrd and Ward. 2004)“ Despite the cost (of salaam) recourse to advances paid by opium traders is advantageous to many rural households since it allows for the purchase of agricultural inputs, provides money to help cover major expenses of things like illness or marriage, and even facilitates the repayment of old debt.” (Rasmussen, pg.2) Credit is an important factor in determining crop selection planting decisions. Credit and investment remains very low in Badakhshan. In order for farmers or farmer groups to engage in value added processing and marketing flexible credit will need to be available.

Access to Land and Sharecropping

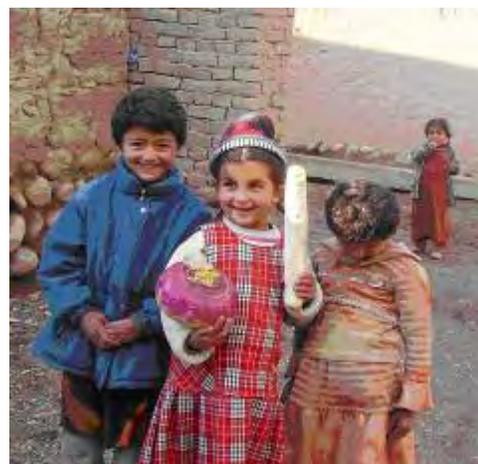
Mansfield and Pain noted that “...the economic advantages associated with cultivating opium poppy differ according to the assets that farmers have at their disposal. For the relatively few large landowners, opium poppy represents a high-value crop that can accrue even greater value if it is sold after the harvest season when prices rise. Through inequitable land tenure arrangements, a landowner can accrue up to two thirds of the final opium yield (despite contributing only 20 percent of the total costs of production) and purchase opium in advance at rates considerably below the harvest price.” (2005, pg 3)

For the land poor, “opium poppy is not just a source of income; it provides opportunities to access land on a sharecropping or tenancy basis as well as drawing on the labor supply of the household. It provides access to both on-farm income and...the means of producing food crops for household consumption. In this way opium can define the ‘creditworthiness’ of the land poor.” (Mansfield and Pain. 2005. pg 3)

Role of Hired and Family Labor

Opium Poppy cultivation also creates the need for hired labor to weed and harvest the crop. It is estimated to be 30 percent to 50 percent of the total labor used. “Where a household has more than one male able to follow the staggered weeding and harvesting seasons, the off-farm income generated from opium poppy can last up to five months, and it is usually higher than the on-farm income they can earn as a sharecropper.” (Mansfield and Pain, 2005, pg. 3) This occurs because of, among others, the high cost of credit.

The return to family labor is a crucial element in the cultivation decisions of farmers. The issue of illicit vs. licit crops is not hectare by hectare, but instead family by family. Family income is the crucial not just yield and income per hectare. Land may not be the limiting factor, but rather family labor. Both opium poppies and intensive crops for export increase at the same time, because land is available. By addressing and increasing the returns to families' scarce resources [labor and capital] are drained away from opium and dedicated to intensive crops like fruit, nuts and vegetables. So for Afghanistan, it should be asked how much land is going into more intensive crops such as vegetables, versus wheat.



Children show off the vegetables grown by their mother with ADP/N extension training.

2. Partial Budgeting

Introduction

The factors considered in making opium poppy cultivation decisions are clearly not a single focused response to prices. But prices, costs and net income derived from competitive crops can play a part in the decision making process. The net returns or income is examined for opium poppy, wheat and the eleven types of vegetables supported by ADP/N in Badakhshan province. This is done to examine the net returns (rather than gross returns) to these crops. While many other factors come into play when the producer makes a decision to cultivate a particular crop, the financial returns and farmer responses to prices have been shown to play a role in the decision. This analysis will present all of the data and information in a detailed format allowing the reader to change assumptions or allow for changed circumstances.

Unit Activity Budgets and Partial Budgeting

To do this we employ unit activity budgets or partial budget analysis. This is a budget which applies only to a particular investment activity, in this case the costs and income associated with opium poppy, wheat and vegetables. "This approach is related to the partial budgeting commonly used by farm management specialists in that it examines the return to a single activity on the farm rather than the farm [or household] as a whole, with that one activity incorporated in the cropping pattern." (Gittinger 1982, pg.141) The budgets developed examine the costs and returns per hectare to the individual farmer.

The limitations of this kind of analysis are the failure to access the effect of undertaking a new activity on the resource use of the farm and on overall farm income. Whole farm budgeting can be used to address some of the limitations and is the preferred analytical tool for project decision making. Whole farm budgets are needed to test the feasibility of the cropping pattern and the financial viability of the farm enterprise. Time and resources were not available and circumstances not appropriate to perform whole farm budgeting.

Partial Budget Uses and Opportunity Costs

Agricultural development is often initially about increasing physical production. Partial budgets are a tool for helping to search out the best combination of production activities. Partial budgets estimate not only the gross income of an activity but also the marginal costs, ideally including opportunity costs, of adding a production activity and compares it with the marginal increase in income and other benefits the new activity will create. From the analysis of cash income and costs, it can be determined if farmers will have cash on hand to purchase improved technology or pay for credit.

As is done in this research, the benefit stream for using improved varieties of seed (and provision of technical assistance) is built up by multiplying the total area planted by the expected yield. This may hide crucial information about effects on individual farmers and markets and obscure underlying unrealistic assumptions as well as opportunity costs associated with the chosen activity.

Opportunity cost is the benefit foregone by using a scarce resource for one purpose instead of for its next best alternative use. Unit activity budgets are used to good effect where specification of opportunity costs for land or labor is not crucial. However, partial budgets can be used to consider a comparison of alternatives for cultivation by the producer. While land is likely not the constraint, hired and family labor opportunities will be crucial in farm household cultivation decisions and trade-offs.

Assumptions and Caveats

Many assumptions are made in the analysis that follows. Several cross cutting assumptions are discussed in this section.

For example, it is assumed that wheat straw and opium poppy stalks and oil are mostly consumed on the farm. But this also partially the case with wheat grain and vegetables, crops grown for food security purposes. The reasoning is this: This analysis is designed to examine the realistic, not optimal, choices faced by the producer, choices that reflect the likely market for both the primary and secondary products. It is possible to have a project in which home consumed output increases enough for the return to the economy to be quite attractive but in which so little of the increased production is sold that farmers will not have the cash to repay loans. (Gittinger. 1982. pgs. 56-57). Omitting or reducing home consumed production from the calculation of economic benefits may favor commercial crops like opium. This report describes the economic importance of this home consumption.

Another assumption is that “before and after” comparisons made on vegetable yield improvements are proxies for comparisons of effects “with and without” ADP/N. Ideally the with and without project comparison better tracks project effects by interviewing farmers who use project inputs in contrast to those farmers who do not. Many factors such as weather and market conditions can vary over time. However, survey constraints favored interviewing farmers who are collaborating with ADP/N. This may also be the case with the previous year, 2006, where seed kits were also distributed (by the USAID RAMP Project) for five vegetables and

wheat. The estimated increase in yields may have been affected by prior use of improved varieties, different weather conditions and a different set of market conditions. With those caveats we use the before and after analysis to estimate increases in yields.

The following three sections of this report will use the same structure or model to estimate net income for opium poppy, wheat and selected vegetable. For each there is a description of:

- Data Sources
- Yield Estimates
- Price Estimates
- Seed and Fertilizer Costs
- Hired and Family Labor Use and Costs
- Other Income (Where Appropriate)
- Other Costs (Where Appropriate)

3. Opium Poppy Net Income Estimates

Opium Poppy Introduction

Opium poppy production in Northeastern Afghanistan has fluctuated significantly over the last four years. Prices have also fluctuated. The characteristics of opium poppy discussed above make it less price responsive and its cultivation more persistent. But prices do play a role in the decision making process. When opium poppy prices decline to the low levels reported recently in Badakhshan, other crops clearly become more competitive, especially intensive crops such as vegetables.

Opium Poppy Data Sources

Opium Poppy production data are provided by two sources. The United Nations Office on Drugs and Crime (UNODC) published the “Afghanistan Opium Survey 2007, Executive Summary.” in August 2007. Similar reports have been published for prior years. The data consisted of cultivation, production, yields and prices for fresh and dry opium in Badakhshan in 2007. (See Table 1: Opium Poppy Production and Price Estimates, North-East Afghanistan and/or Badakhshan, 2004-2007.) This data allowed for the calculation of gross income from fresh opium for those years.

Table 1, Opium Poppy Production and Price Estimates, North-East Afghanistan and/or Badakhshan, 2004-2007

Description	Year			
	2004	2005	2006	2007
Cultivation (ha)				
North-East region	16389	8734	15336	4853
Badakhshan	15607	7370	13056	3642
Production (MT)				
North-East region	724	365	594	195
Badakhshan			503	152
Yields (kg/ha)				
North-East region	44.2	41.8	38.5	40.7
Price fresh opium (US\$/kg)				
North-East region	\$42	\$76	\$79	\$71
Gross Income Fresh Opium (US\$/ ha)	\$1,856	\$3,177	\$3,042	\$2,890
<i>Source : UNODC 2005, 2007</i>				

The second source of data was the staff of ADP/N. These estimates do not include area cultivated or production but do include estimates of yields for good, average and poor irrigated poppy as well as rain-fed poppy yields. ADP/N staff also noted local lower prices for fresh opium in Badakhshan. Staff estimates were also applied to costs of fertilizer and hired labor. These estimates appear in Table 2: Opium Poppy: Estimates of Net Income, Badakhshan, 2007. The column "UNODC-based Poppy Net Income Estimates" uses yield and prices from UNODC. Cost estimates by ADP/N staff are used to calculate net income. The primary difference in the UNODC estimates and ADP/N is the price for opium and the resulting higher UNODC gross income estimates.

Table 2, Opium Poppy: Estimates of Net Income, Badakhshan, 2007

Description	UNODC based Opium Poppy Net Income	Cultivation Type			
		Irrigated			Rain-fed
		Good	Average	Poor	
Poppy Yields: pao/jerib		16	13	10	6.5
Poppy Yields: kg/ha	40.7	40	33	25	16
Price Fresh Opium (Afs/pao)		1200	1200	1200	1200
Price Fresh Opium (US\$/kg.)	71	\$60	\$60	\$60	\$60
Gross Income Fresh Opium (US\$/ha.) *	\$2,890	\$2,400	\$1,950	\$1,500	\$975
Additional Income					
Poppy Stalks & Oil	\$83	\$83	\$83	\$42	\$42
Total Gross Income	\$2,973	\$2,483	\$2,033	\$1,542	\$1,017
Costs (US\$/ha.)					
Fertilizer: DAP (\$22/bag) 1	110	110	55	0	0
Fertilizer: urea (\$12/bag) 2	120	120	60	0	0
Subtotal Fertilizer	230	230	115	0	0
Hired Labor, Weeding & Harvesting for Irrigated Poppy (28 days/jerib x \$4 wages, meals)	560	560	560	560	
Hired Labor, Weeding & Harvesting for Rain-fed Poppy (14 days/jerib x \$4 wages, meals)					280
Total Cost	\$790	\$790	\$675	\$560	\$280
Net Income	\$2,183	\$1,693	\$1,358	\$982	\$737

Sources: UNODC (2007) and ADP/N Estimates

Notes

* Only Yield and Price information in UNODC column are from UNODC estimates; Costs are from ADP/N estimates.

1 - Good yield results from 5 bags of DAP and 10 bag of Urea fertilizers

2 - Average yield results from half of the fertilizer inputs needed for good yield

Conversions

1 Hectare = 5 jerib; 1 seer = 7 kg; 1 kg = 2.5 pao; Currency Exchange \$1 = Afs 50

Additional income

Poppy stalks 400kg/jb = 2,000 kg/ha @ Afs 6/kg = \$240 per ha

Poppy seed oil, 5 seers oil/jerib = Afs 350/seer

For Stalks and Oil, the total Value 415\$US multiplied by 20% for marketed value = \$83

(Half value is assumed for poor and rain-fed production of Poppy)

Other costs

Family Labor

Seed: No cost

Opium Poppy Yield Estimates

Opium yields vary by rain-fed and irrigated land with good, average and poor yields. An assumption is made that the quality and/or quantity of the yields correspond to the level of inputs applied. For good yields the farmer is assumed to apply the optimal quantity of fertilizer, for average yields half the optimal fertilizer is assumed to be used. and for poor yields manure is assumed to be used. Reality is likely more complex. The ADP/N staff is not responsible for the assumptions of input intensity to productivity made in this report.

Opium Poppy Price Estimates

UNODC reported the price of fresh opium to be US\$ 71/kg. This price is applied to the UNODC cultivation, production and yield data to calculate the gross income per hectare for fresh opium in Badakhshan in 2007 in Table 1 and Table 2. ADP/N estimated prices range from 50 to US\$ 60/kg and even lower (35-40) earlier in 2007. The US\$ 60/kg estimated price was used with the ADP/N production calculations to again keep data sources as consistent as possible.

There are also potential opium quality issues. UNODC analysis indicted that one of the reasons for lower prices paid for opium in Northern Afghanistan (It unclear whether this statement includes Badakhshan.) is lower heroin and morphine content. Transportation costs to the major processing areas in the southern area of Afghanistan are also noted as a reason for lower prices. Greater production of opium in 2006 may have resulted in over production and lower prices initially in 2007. This may also have contributed to the significant reduction in poppy area planted in Badakhshan in 2007.

Opium Poppy: Fresh or Wet and Dry Opium

Opium is sold fresh (i.e. “wet”) or dry. UNODC report both prices but does not estimate volumes sold for each price. According to Pain (2006, pg.121) “...large quantities of opium [are] produced by farmers to repay their debts and not sold directly on the market (instead held by creditors as inventories to respond to subsequent price opportunities). The ADP/N staff has noted that despite the unit price rise for dry opium, opium often incurs a loss of value over time. To illustrate: “If a farmer harvests 1 pao (400g) of opium, he can sell his crop fresh for US\$ 40/pao at the farm gate, sell it in a month at a rate of US\$ 50/pao, or sell it in a year at US\$ 70/pao. However, in a month the moisture loss would mean he only had 300g of opium, and in a year he would have only 200g of dry opium. Therefore it is possible that the opium volume decreases faster than the price rises.” (ADP/N staff) This will depend on the water content of fresh opium. If weather conditions result in fresh opium containing more water, it would lose more weight while drying. (Pain. 2006. pg. 121). Dry opium prices in July 2007 in Northeastern Afghanistan were US\$ 87/kg., significantly lower than other regional dry opium prices (MCN/UNODC. July 2007. pg.1).

Opium Poppy Other Income: Poppy Stalks and Poppy Seed Oil

Poppy stalks provide an important source of household fuel. “Anecdotal evidence suggests that one hectare of opium poppy will provide fuel for a household of 20 people until the onset of

winter.” (Mansfield 2006, pg. 57) We assume that most poppy stalks are consumed by the household but have estimated production as 400 kg/jerib or 2,000 kg/ha and prices of Afs 6/kg or \$US 240/ha. An estimate of home consumption will take uninformed guess work. In this case we assume that 80% is retained for home consumption. Another source of income is poppy seed oil. ADP/N staff assumes a production of 5 seers per jerib and priced at Afs 350/seer. It is also assumed that 80% is kept by the household. The total potential value of stalks and oil is US\$ 415/ha. Assuming that 20 % is sold results in a joint value of US\$ 83/ha. Half of this value is estimated for poor irrigated yields and rain-fed yields. These are the financial effects of opium bi-products. A full economic analysis would take account of the value to the farm household of home consumption.

Opium Poppy Costs: Fertilizer Use Assumptions

See discussion of yields above. It is assumed that good yields results from 5 bags of DAP and 10 bags of Urea at US\$ 22 bag and US\$ 12 bag, respectively. Average yields results from half of the fertilizer use and costs needed for good yields. It is assumed that poor yields result from use of manure by poorer farmers.

Opium Poppy Costs: Hired Labor Costs and Family Labor

Estimates for labor use in opium production combine information, insights and assumptions from Mansfield (2004, pg. 9) and ADP/N staff. Mansfield assumed 70 labor days per jerib or 350 labor days per hectare. He also assumed that 30% of total labor was hired and 70% family labor. He goes further in differentiating between weeding (18 days of hired labor per jerib) and harvest (6.25 hired labor days per jerib). He also assumes weeding labor and meal costs at 3US\$ per day of labor for a total weeding cost of US\$ 54 per jerib. For harvesting he assumes labor plus meals cost of US\$ 7.15 for a total per jerib harvesting cost of US\$ 45 per jerib. This results in total hired labor costs of more or less US\$ 100/jerib or US\$ 500 per hectare. Mansfield also noted that rain-fed poppy costs would be less because rain-fed poppy is only weeded once instead of the three weedings of irrigated poppy. Under these assumptions 245 days of family labor is used in irrigated poppy production.

The ADP/N staff has made another set of assumptions and estimates regarding the use of labor in opium poppy production in Badakhshan. These estimates combine weeding and harvesting. They also assumed 55 days per jerib (275 days/ha.) total labor for irrigated poppy and 27 days of labor per jerib (135 days/ha.) for rain-fed poppy. Approximately half of this labor is assumed to be hired and half family labor. The cost of labor and meals is assumed to be US\$ 4 per day for both weeding and harvesting. The total hired labor cost for irrigated poppy is US\$ 560/ha. (28 days*5jeribs per hectare*US\$4 per day). The total of 14 hired labor days for rain-fed poppy results in costs of US\$ 280/ha. The labor assumption of 55 days per jerib is lower than the Mansfield estimate of 70 days per jerib because the climate is higher and cooler in Badakhshan than in Nangarhar where the cited Mansfield research was performed. However, the hired labor cost estimates of US\$ 500/ha. by Mansfield and US\$ 560/ha by ADP/N staff are reasonably similar given the varied sets of assumptions being used. Under the ADP/N assumption only approximately 140 days of family labor is used in irrigated poppy production.

Opium Poppy Other Costs: Hidden Security Costs

It is assumed that there are additional, hidden security costs associated with protecting and guarding opium poppy production activities. But this assumption may be counterbalanced by, in behavior noted by Mansfield (2004), greater use of family labor in opium poppy harvesting in order to prevent theft.

Opium Net Income Summary

This research identifies the salient role of prices and high levels of hired and family labor use and cost in determining net income for opium poppy production. Given the high variable costs in hired labor associated with achieving good opium poppy yields, there is a sizeable reduction in net revenue compared to gross income of wheat and vegetables. While there remains a significant potential increase in opium poppy prices versus some other intensive crops, low opium poppy prices clearly improve the competitive position of alternative crops, at least in terms of net income.

4. Wheat Net Income Estimates

Wheat Introduction

Cultivating wheat is primarily a food security decision. “The returns on wheat do not have to compete with opium poppy to shift the balance between wheat and opium poppy cultivation. Under current conditions in Afghanistan most households are more concerned about food security than about profit. ...households have few options but to cultivate wheat on their own land to guarantee food supplies and have been found to do so even at the expense of opium poppy cultivation.” (Mansfield 2006, pg 61)

Wheat is a basic grain. Wheat supply, like opium, is considered less responsive to price signals. But wheat prices in Badakhshan have also been increasing, making the relative competitiveness of wheat with (lower prices for) opium poppy much improved. When factoring in the on-farm value of wheat straw in terms of wheat’s contribution to the agricultural economy we also find an on-farm reason favoring wheat cultivation over opium poppy.

Wheat Data Sources

See Table 3: Wheat: Estimates of Net Income per Hectare, Badakhshan, 2007. The cultivation, production, yields and price data for irrigated and rain-fed land for Badakhshan are published in the Afghanistan Ministry of Agriculture, Irrigation and Livestock (MAIL) 2007 “Agriculture Prospects Report.” ADP/N staff agreed with the MAIL estimates. ADPN staff estimates were used to calculate the yield and value of wheat straw and the use and cost of locally used fertilizer. ADP/N staff also described and estimated the use of hired and family labor for irrigated and rain-fed wheat. Price estimates reviewed included ADP/N market prices, FEWS NET and MAIL/FAO data.

Table 3, Wheat: Estimate of Net Income per Hectare for Badakhshan, 2007

Description	Type of Cultivation					
	Irrigated			Rain-fed		
	Measure	(Afghan measure)		Measure	(Afghan measure)	
value		Unit	value		Unit	
Gross Income						
Cultivation (ha.)	25,000			110,000		
Production (mt.)	63,000			138,000		
Yields (mt./ha)	2.52	72	seer/jerib	1.25	35.84	seer/jerib
Price (US\$/kg)	\$0.28	98	Afs/seer	\$0.28	98	Afs/seer
Gross Income wheat (US\$/ha.)	\$705.60	7056	Afs/jerib	\$351.27	3512.73	Afs/jerib
Additional Income from Straw						
Straw production (60 bags/irrigated ha. and 40 bags/Rain-fed ha.); 20% is sold at \$10 / bag	\$120.00			\$80.00		
Total Gross Income	\$825.60			\$431.27		
Costs						
Seed and Fertilizer	\$175.00	35	\$/jerib			
Net Income						
Wheat only	\$530.60			\$351.27		
Wheat & straw	\$650.60			\$431.27		

Sources: MAIL (2007), ADP/N Staff Estimates

Note:Conversions

1 Hectare = 5 jerib

1 seer = 7 kg

Currency Exchange \$1 = Afs50

Additional cost

Family labor 41 day per hectare

Cost of hired labor if over 5 jeribs is \$ 20 (Afs 1000)

Costs of threshing tractor (if used) for 1-2 jeribs is 10% of grain corps

Wheat Yield Estimates

In Table 4: Wheat Production in Afghanistan, 2003 – 2007 we note the variability of weather on rain-fed and irrigated wheat production. In years prior to 2007, irrigated wheat yields remained relatively stable except for the severe drought in 2004. The yields for rain-fed wheat were much more variable. 2007 recorded the largest rain-fed yields since 2003. Yields reported are average yields for 2007 for irrigated and rain-fed wheat.

Year	Rain-fed	Irrigated
2003	1.345	3.017
2004	0.426	1.867
2005	1.538	2.728
2006	0.759	2.604
2007	1.606	2.878
<i>Source: MAIL, 2007</i>		

Wheat Prices

Wheat prices in Badakhshan have been rising. One estimate (FEWSNET 10/05/2007) of wheat prices was Afs 24/kg or US\$ 0.48/kg in Faizabad. FAO (10/2007) quoted wheat prices in the Northeast region of Afghanistan as being Afs 15.3/kg or US\$ 0.31/kg. We used the MAIL estimate of US\$ 0.28/kg to remain consistent with the cultivation, production and yield sources. The FAO analysis expected to see further price increases. Transportation costs and fuel prices partially explain these increases. Another analysis expects the result of a good 2007 wheat harvest to lower prices in the region. (FEWS NET, May/June 2007)

Wheat Straw

There is significant potential income from the sale of wheat straw. It is estimated that wheat straw sells for up to 90 % of the value for grain. We assume that 80% of the straw is consumed on the farm while 20% is marketed. Using a different approach we arrive at similar estimates: Assume a yield range of 8 – 12 bag/jerib between rain-fed and irrigated wheat. If 20% is sold on the market for US\$ 10 per bag, then the resulting income per hectare is US\$ 120/ha. for straw from irrigated wheat and US\$ 80/ha. for straw from rain-fed wheat. The value of home consumption is significant for both grain and straw.

Wheat Improved Seeds and Fertilizer Cost

ADP/N-provided wheat seed and fertilizer kits cost US\$ 44/jerib. This is the high end of the market. ADP/N staff estimated that most farmers spend approximately US\$35/jerib on wheat seed and fertilizer from local markets. The value for improved wheat seed and fertilizers is US\$ 220 versus US\$ 175 for seeds and fertilizer bought in the local market.

Wheat Labor Cost Assumptions

In Badakhshan, ADP/N staff estimated that farmers with more than 5 jeribs of land will likely hire laborers for about 5 days. The remaining estimated labor per jerib is 20 family labor days. The estimate per hectare totals 125 days of labor for irrigated wheat. Smaller farmers use family labor exclusively. Total labor estimates for rain-fed wheat are 3 days of hired labor per jerib for larger farmers and 12 days per jerib of family labor. Mansfield estimated 8 days per jerib or 40 days per hectare but assumed use of family labor only. Likely because of use of primarily family labor in wheat growing, labor estimates will vary. The price of labor is assumed to be US\$ 4.

Wheat Threshing Costs

Smaller farmers are more likely to incur threshing costs. In part because of the high cost of fodder straw, many farmers with only 1-2 jeribs of land do not own bulls and have to hire a tractor for threshing their grain. Tractor owners generally charge ten percent of the grain for their services. (ADP/N staff)

Wheat Net Income Summary

A comparison between opium poppy and wheat, while indicating higher returns to opium poppy production, shows that the ratio of ten to one when using gross income is reduced to three (or even two) to one when using net income. Further reductions can be expected with use of improved seed varieties resulting in increased productivity. A major difference is the almost exclusive use of family labor with less overall labor required in wheat production versus opium poppy production. Average wheat yields produce a net income of US\$ 650/ha. compared to average opium poppy net income of US\$ 1,358/ha. while good opium poppy yields produce US\$ 1,693/ha. using ADP/N estimates and US\$ 2,183/ha. using UNODC estimates. High yield rain-fed wheat net returns of US\$ 431/ha. contrast with rain-fed opium poppy net returns of US\$ 695/ha., a less than two to one ratio (1.6: 1).

5. Vegetables Net Income Estimates

Vegetable Introduction

Vegetables, like wheat and opium poppy, have attributes that favor their cultivation and attributes that do not favor their cultivation. The role a given attribute plays depends on the particulars of the situation. One factor is the competition for water with wheat and opium poppy. Another factor is the socio-economic position of the farm household. Poorer households may limit vegetable cultivation to a small number of crops for household consumption. The relatively resource-wealthy are more likely to produce a range of high-value vegetable and fruit crops for both consumption and sale. "Landholdings of this latter group may be such that they not only produce sufficient wheat for household consumption but also have a surplus for sale. This differs markedly from the situation faced by households with small landholdings and large numbers of household members." (Mansfield. 2006. pg 53) Another factor is the relatively high use of labor in this intensive activity, thus creating employment potential. Finally, vegetables vary in terms of their transportability which affects their relative marketability.

Vegetable Data Sources

Vegetable data sources include: the ADP/N Economic Impact Analysis, Fall 2007, Vegetable Seed Distribution Questions (vegetable survey) for yields, prices, and farmer estimates of yield improvements over the previous year; ADP/N market town vegetable prices in Badakhshan; ADP/N seed and fertilizer costs and area planted and ADP/N staff estimates of hired and family labor. While yields and other data are reported on a per jerib or per hectare basis for comparison purposes, the actual amount planted to vegetables is usually smaller. The vegetable yield data used in this analysis establishes a baseline for traditional crops as well as a baseline for newly introduced vegetable crops. This is supported by the work of the Technology Transfer Centers (TTCs). Future ADP/N post-harvest vegetable surveys will build upon and truth test this baseline data.

Vegetable Yields

Table 5: Vegetables: Estimates of Net Income, Badakhshan, 2007 reports median yields calculated from the vegetable survey of 364 farmers. ADP/N staff assesses the yield results as being on the “low side by western standards” and are the most conservative and realistic estimates. However, producer potato yields of 17.5mt/ha. for Badakhshan were not out of line with countries in the region as reported by the International Potato Center. For example, Pakistan estimated yields at 13mt/ha., Iran 21mt/ha., and India 17mt/ha.

(www.cipotato.org/potato/facts/indicators.asp).

Vegetable	Yields	Price	Gross Income	Cost: Seed/ Fertilizer	Cost: Hired Labor	Cost: Total	Net Income
	kg/ha	US\$/kg	US\$/ha	US\$/ha	US\$/ha	US\$/ha	US\$/ha
Tomato	23,333	\$0.12	\$2,800	\$270	\$120	\$390	\$2,410
Pepper	2,000	\$0.34	\$680	\$295	\$60	\$355	\$325
Eggplant	25,000	\$0.12	\$3,000	\$215	\$60	\$275	\$2,725
Potato	17,500	\$0.14	\$2,450	\$1,155	\$160	\$1,315	\$1,135
Onion	28,000	\$0.16	\$4,480	\$255	\$160	\$415	\$4,065
Cucumber	10,000	\$0.20	\$2,000	\$340	\$80	\$420	\$1,580
Carrot	17,500	\$0.12	\$2,100	\$255	\$120	\$375	\$1,725
Turnip	25,100	\$0.10	\$2,510	\$235	\$120	\$355	\$2,155
Cabbage	9,771	\$0.20	\$1,954	\$255	\$80	\$335	\$1,619
Cauliflower	10,000	\$0.50	\$5,000	\$285	\$80	\$365	\$4,635
Okra	10,500	\$0.30	\$3,150	\$215	\$60	\$275	\$2,875

Sources: ADP/N Vegetable Survey (fall 2007), ADP/N Staff Estimates

Vegetable Prices

The vegetable survey median farm gate prices were used to calculate gross income. The prices are within a normal seasonal fluctuation in vegetable prices as tracked by the market town price data collected by ADP/N. Regional price information developed by FAO/MAIL show vegetable prices to be relatively high in Afghanistan. (FAO.org/es/ESA/en/pubs_tfr.htm)

Vegetable Costs: Seed and Fertilizer

Table 6: Vegetables: Estimates of Production Costs , Badakhshan, 2007 shows the ADP/N actual costs per hectare for the kits of seed and fertilizer for each vegetable. The seeds and fertilizer are provided through local merchants using a voucher system.

Vegetables	Total Labor	Hired Labor (20%)	Family Labor (80%)	Price of project seed kits
	days/ha	days/ha	days/ha	US\$/ha
Tomato	150	30	120	270
Pepper	75	15	60	295
Eggplant	75	15	60	215
Potato	200	40	160	1155
Onion	200	40	160	255
Cucumber	100	20	80	340
Carrot	150	30	120	255
Turnip	150	30	120	235
Cabbage	100	20	80	255
Cauliflower	100	20	80	285
Okra	75	15	60	215
<i>Source: ADP/N Estimates</i>				

Vegetable Costs: Hired and Family Labor

Table 6 also presents the total labor estimates made by ADP/N staff for each vegetable. These estimates draw upon ADP/N staff estimates and TTC experience. The original estimates are made in terms of per jeribs (not shown) and are converted to hired labor per hectare in the vegetable net income estimates Table 5. The total labor estimates reflect the varying level of labor required for weeding and harvesting, with potato and onions needing more labor. The ADP/N staff has further assumed that 20% of the total labor requirement for each vegetable is hired labor and 80% is family labor. It is again assumed the costs of US\$ 4/day for agricultural labor. The ADP/N market data supports this assumption.

Vegetable Net Income Summary

Growing vegetables is not only a food security decision but also represents an income diversification opportunity for the farmer. The results are indicative but support the assertion that improving and increasing vegetable production yields and profitability can create economic

opportunities for the farmers of Badakhshan. Much will depend upon actions that increase market access as well as ADP/N activities to increase access to improved technology and credit. “Even in good years when climatic factors are favorable, distance to markets, poor physical infrastructure, limited local purchasing power... make the cultivation of higher-value agricultural crops much less profitable.” (Mansfield. 2006. pg 64) Transportation issues constrain access to larger markets outside of Badakhshan and limited local purchasing power, with the exception of those gaining from opium poppy production, constrains the size of the local market for vegetables. Nevertheless, the results of this analysis reveal significant competitive potential for many vegetables compared to opium poppy. Vegetable production also has substantial potential for use of hired labor and the benefits of intensive (greenhouse) cultivation should be expanded.

6. Summary Analysis

Partial Budget Comparisons

The partial budget net income calculations presented above represent a snap-shot picture taken in 2007 of a given set of conditions and assumptions. The conditions will change and assumptions adjusted as better information is collected and analyzed. The salient features for each calculation are described below. Comparisons between crops are drawn in each discussion.

Price Responsiveness: Agriculture commodity prices generally respond to actual and anticipated changes in supply and demand conditions. Weather can produce large fluctuations in farm production resulting in large swings in farm prices and incomes. This production and price variability is a key element in market risk. It has been mentioned elsewhere in this report that there are factors that dampen the price movements in response to changes in supply and demand: access to credit, land and jobs for opium, food security and economically valuable straw for wheat combined with market demand and potential demand for vegetables.

The prices for opium, fresh and dry, are lower in the Northeastern Afghanistan region than in other regions of the country, contributing, in part, to a reduction in 2007 in area cultivated in Badakhshan. However, the price decline, at least as reported by UNODC (which reported higher price estimates than ADP/N), may be somewhat price inelastic, as argued earlier in this report. There is, however, greater potential for increases in prices with opium poppy, all things considered, compared to wheat and vegetable crops. Wheat prices have also been rising in Badakhshan, nearing at times a doubling of the prices used in this analysis. A drop in prices due to a good growing season in 2007 is anticipated. Nevertheless, there appears to be some potential for local price rises because of transportation costs and increasing prices for wheat brought into the region. Finally, there seems to be a strong, and perhaps less volatile, demand for fresh vegetables which dampens price movements. However, market access and improved local household incomes will be needed in order to create demand for the increased supply created by an increased productivity of local vegetables.

Cost of Seed and Fertilizer: To calculate net income we have estimated the cost of seed and fertilizer for opium poppy as practiced, local wheat practices and potential and improved vegetable seed and fertilizer kits. For opium the estimated cost of fertilizer was US\$ 230/ha. to achieve good yields and half that estimate for average yields. Poor yields and rain-fed opium

experienced no financial costs. The cost for local market wheat seed and fertilizer was US\$ 175/ha. and US\$ 220/ha. for ADP/N better quality wheat seed and fertilizer. With the exception of potato (with a seed potato cost of US\$ 1,155/ha.) vegetable seed costs range between US\$ 215/ha. for eggplant and okra and US\$ 340/ha. for cucumber. (See Table 5 and Table 6) While vegetable seed prices affect the net income for each vegetable and some more than others, there does not appear to be significant cost differences between seed and fertilizer for opium poppy, wheat, either local or improved, and most kinds of ADP/N supported vegetables. However, higher costs for some seed kits may affect the ability of poorer farms to use such technology packages.

Hired and Family Labor:

There is greater variation in the use of hired and family labor comparatively between opium poppy, wheat and vegetables. The estimates for opium poppy range from 350 days/ha. with 30% being hired and 70% family (by Mansfield) to (APD/N's) 275 days/ha. with half being family labor. For wheat, family labor is used in almost all cases except where the producer has more than one hectare where he then employs five days of hired labor per hectare. For vegetables labor estimates made by ADP/N vary by vegetable type. (See Table 6:



Farmers inspect cole crops during a field day at the Faizabad Technology Transfer Center, 2007.

Vegetables: Estimates of Production Costs, Badakhshan, 2007.) In terms of the percentage of hired to family labor the ADP/N staff estimated that 20% of the labor for each crop was hired and 80% was family. Clearly the financial costs of labor for opium are much greater and create much greater off-farm employment opportunities than either wheat or vegetables. However, vegetables provide for greater use of hired labor and (returns to) family labor than does irrigated wheat in many cases.

The costs of hired labor in opium poppy production significantly reduce the returns to the opium poppy producer. The assumptions of greater proportional use of family labor in vegetable (and wheat) production accounts, in part, for the net returns. However, the significant use of family labor in opium production makes the returns to family labor from opium poppy production an important element in the decision making process. Vegetable production can also provide family labor opportunities, especially as cultivation techniques become more specialized.

Net Income: Gross income estimates and comparisons that exclude estimates of costs ignore, by doing so, many quantitative and qualitative issues in the farm decision making process. While the calculation of net income, absent estimates of opportunity costs and economic benefits, is far from ideal, it provides greater complexity to the analysis than a comparison of gross income. From the calculation of net income or returns we conclude that in 2007 in Badakhshan, the ratio of net returns versus gross return for average yields of irrigated wheat to average yields of opium poppy is two to one or at most three to one. That is average wheat yields produce a net income of US\$ 650/ha. compared to average opium poppy net income of US\$ 1,358/ha. and good yields produce, using UNODC production and price estimates, US\$ 2,183/ha. in net returns. This is in contrast to the UNODC (2007) claims, based on national gross income estimates for opium poppy and wheat, of ten to one, a still significant but much closer competitive position. This may be a regional variation, but an important variation.

Furthermore, the net returns to vegetables reported by the ADP/N vegetable survey shows the market potential and relative productivity and profitability of almost all of the vegetables supported by ADP/N. (See Table 5: Vegetables Estimates of Net Income, Badakhshan, 2007.) Nine of eleven vegetable crops exceed the average opium net returns and six types of vegetables exceed the higher production and price opium poppy estimates. As ADP/N addresses issues of market access and regional economic infrastructure (roads) development, the market potential for vegetables can be realized. The robustness of the net income comparison between opium poppy and vegetables supports what some in the field in Afghanistan have asserted: vegetables are competitive with opium poppy, at least in terms of net income, given prices, etc.

Incremental Returns to Use of Improved Seed and Fertilizer

In Table 7: Vegetables: Estimates of Incremental and Regional Production and Gross Income, Badakhshan, 2007 we calculate the total production for each vegetable by multiplying median or average yields by the area planted to that crop. The vegetable survey asked the ADP/N participant producer to estimate the yields for the previous year. From this difference the percentage improvement in yield was calculated. The incremental yield was then calculated (total production minus [total production divided by 1 plus % increase in yields]). To get the three income estimates we used the farm gate price reported in the vegetable survey. To get the value of the incremental yield we multiplied the incremental yield by the price. To get the incremental income per hectare we divided the incremental value by area planted. We calculated the total value by multiplying the total production for each vegetable by its price. Finally we totaled the value of the incremental yield attributable to ADP/N inputs as well as the total production, some of which would have occurred without the project.

Vegetables	Production					Income			
	Yields	Area Planted	Total Prodn.	% Increase in Yields	Incremental Yield	Farm Gate Price	Value (Incremental Yield)	Incremental Income per ha.	Total Value
	<i>kg/ha</i>	<i>ha</i>	<i>kg</i>	<i>%</i>	<i>kg</i>	<i>US\$/kg</i>	<i>US\$</i>	<i>US\$/ha</i>	<i>US\$</i>
Tomato	23,333	954.6	22273681	17	3236347	\$0.12	\$388,362	\$407	\$2,672,842
Pepper	2,000	30	60000	40	17143	\$0.34	\$5,829	\$194	\$20,400
Eggplant	25,000	53	1325000	26	273413	\$0.12	\$32,810	\$619	\$159,000
Potato	17,500	420.2	7353500	35	1906463	\$0.14	\$266,905	\$635	\$1,029,490
Onion	28,000	1674.6	46888800	29	10540893	\$0.16	\$1,686,543	\$1,007	\$7,502,208
Cucumber	10,000	66.2	662000	17	96188	\$0.20	\$19,238	\$291	\$132,400
Carrot	17,500	440	7700000	22	1388525	\$0.12	\$166,623	\$379	\$924,000
Turnip	25,100	430	10793000	14	1325456	\$0.10	\$132,546	\$308	\$1,079,300
Cabbage	9,771	110.8	1082626	100	541313	\$0.20	\$108,263	\$977	\$216,525
Cauliflower	10,000	500	5000000	19	798319	\$0.50	\$399,160	\$798	\$2,500,000
Okra	10,500	322.5	3386250	28	740742	\$0.30	\$222,223	\$689	\$1,015,875
					Total		\$3,428,499		\$17,252,040

Source: ADP/N vegetable survey and market data

We were unable to make similar calculations of incremental costs because of lack of data. However, the incremental income per hectare for vegetables is substantial given the modest yield and yield increase estimates. There is a wide range from US\$ 194/ha increase in income for pepper to US\$ 1,007/ha increase in income for onion. The mean incremental increase per hectare is US\$ 573. From the point of view of the producer, many vegetables' incremental increase in income exceeds the total cost of inputs, not just the assumed lower incremental costs.

The vegetable yield and income calculations used here are based on a single year survey so lack the reliability of a longer time series as was available in part for opium poppy and wheat estimates. Nevertheless, the net income and incremental income per hectare results suggest substantial potential for even greater productivity and profitability as well as improved food security from vegetables, including traditional crops like potato, tomato and onion.

Regional Incremental and Total Economic Effects

We have also reported estimates of US\$ 3,428,000 for incremental yields and US\$ 17,252,040 for total production. It bears repeating that while the benefit stream for vegetable crops can be built up simply by multiplying the total area planted by the yield, it may hide crucial information about effects on individual farmers and markets and obscure underlying assumptions. Without a fully articulated cost/benefit analysis the process of adding up financial benefits will be of limited initial use. Such estimates will provide, however, benchmarks for comparisons of improvements in productivity and profitability.

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Annex 1: Suggestions for Further Research

The following suggestions arise in response to issues raised in this report.

Future research into cultivation decisions should attempt to expand the framework or context considered as well as provide evidence, even if only anecdotal, of its application to conditions in Badakhshan.

Economic surveys should be designed (with the exception of opium poppy) to provide data to replace ADP/N staff estimates of yields, seed and fertilizer costs, hired labor cost and family labor use for each type of vegetable and wheat, rain-fed and irrigated.

If possible, structure the vegetable survey to get yield, cost and other data on a “with and without” basis instead of “before and after.” In theory, there will be fewer factors changing when using the with and without structure.

Structure surveys to provide information on all the economic characteristics of the farm household, in other words a whole farm budget analysis. Develop model farms, minimally large and small producers, to more completely describe opportunity costs.

Perform a complete economic and financial cost benefit analysis. This should include estimates of value adding activities as well as road and irrigation infrastructure improvements as they contribute to market access.