UNODC
United Nations Office on Drugs and Crime

Government of Afghanistan
Ministry of Counter Narcotics

Afghanistan

Survey of Commercial Cannabis Cultivation and Production 2011

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ABBREVIATIONS

ANDS Afghanistan National Development Strategy

AOPS Annual Opium Poppy Survey

CNPA Counter Narcotics Police of Afghanistan

ICMP Illicit Crop Monitoring Programme (UNODC)

MCN Ministry of Counter-Narcotics

NDCS National Drug Control Strategy

UNODC United Nations Office on Drugs and Crime

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2011 Survey of Commercial Cannabis Cultivation and Production

	2010	Change on 2010	2011
Commercial, mono-crop cannabis cultivation[1]	9,000-29,000 ha		12,000 ha (8,000-17,000 ha)
Number of provinces with commercial, mono-crop cannabis cultivation	19	+2	21
Average cannabis resin powder (garda) yield from cannabis in mono-crop cultivation	First Garda: 63 kg/ha Second Garda: 41 kg/ha Third Garda: 24 kg/ha Total: 128 kg/ha	-13%	First Garda: 51 kg/ha Second Garda: 36 kg/ha Third Garda: 25 kg/ha Total: 112 kg/ha
Potential cannabis resin powder (garda) production[2]	1,200-3,700 tons		1,300 tons (1,000-1,900 tons)
Average farm-gate price of cannabis resin powder at time of resin processing (January), weighted by production	First Garda: US$ 86/kg Second Garda: US$ 66/kg Third Garda: US$ 39/kg		First Garda: US$ 95/kg Second Garda: US$ 63/kg Third Garda: US$ 39/kg
Total farm-gate value of cannabis resin production (all garda qualities) As percentage of GDP[3]	US$ 85-263 million 0.7%-2.0%		US$ 95 million (US$ 78-135 million) 0.6%
Cannabis growing households[4]	47,000	+38%	65,000
Average cannabis cultivated per cannabis growing household (all households)	0.33 ha	-12%	0.29 ha
Proportion of cannabis farmers who also grew opium	61%		58%
Average yearly gross income from cannabis of cannabis growing households[5]	US$ 3,000	-20%	US$ 2,400
Income from cannabis per ha (gross/net)	US$ 9,000/8,300	-10%/ -12%	US$ 8,100/7,300

Note: Numbers in parentheses refer to the lower and upper bounds of the estimation range.

[1] Refers to the area with commercial, mono-crop cultivation in the cannabis risk area (23 out of 34 provinces of Afghanistan). Small-scale cannabis cultivation in kitchen gardens, lines of cannabis around fields (bund cultivation) and fields of cannabis mixed with other crops are not considered in this area estimate.

[2] Refers to air-dried cannabis powder (not adjusted for moisture). Includes estimated potential production from fields of cannabis mixed with other crops and from bunds (about 2% of total production). Production from other cultivation types e.g. in kitchen gardens could not be estimated.

[3] Nominal GDP for the respective year. Source: Government of Afghanistan.

[4] The estimate is based on headmen interviews from the village survey. It comprises all cannabis-growing households reported by headmen, i.e. possibly also households with only small-scale cannabis cultivation. The contribution of such households to the total cannabis cultivation area and cannabis production could not be estimated.

[5] Income figures are indicative only; they do not include all expenditure and income components associated with cultivation.

EXECUTIVE SUMMARY

The 2011 Survey of Commercial Cannabis Cultivation and Production estimated the total area under cultivation in 2011 at 12,000 hectares and a potential production of 1,300 tons. These figures only include commercial, mono-crop cannabis cultivation as the survey tool cannot capture small-scale "kitchen garden" cultivation of cannabis, which is often for localized and/or personal use and is only thought to account for a small percentage of total production.

Afghanistan's importance as a producer of cannabis resin does not necessarily mean that it is the principal supplier of the world's big cannabis resin markets in North Africa, Europe and South-West Asia, but its relative importance may be growing whereas that of Morocco, though still very considerable, may be on the decline.[6] Likewise, seizure data imply that not even all the cannabis resin trafficked in South-West Asia originates in Afghanistan.

Signs of both stabilisation and change

In 2011, cultivation and production of cannabis resin in Afghanistan appeared stable and there was no evidence of substantive change in comparison to the previous UNODC cannabis surveys of 2009 and 2010. Nevertheless, the number of cannabis-growing households in Afghanistan increased by 38 per cent, from 47,000 in 2010 to 65,000 in 2011, virtually all of whom were sporadic growers who had chosen that year to cultivate cannabis once again, while only a small amount were first-time cannabis growers.

Moreover, commercial cannabis resin cultivation has spread to more and more provinces, being cultivated in almost two thirds of them (21 provinces) in 2011 as opposed to in only half (17 out of 34) in 2009. Principal among the numerous contributing factors to the spread of cannabis cultivation in Afghanistan is the fact that the price of cannabis has increased dramatically in the past few years, with best quality resin rising from US$ 35/kg to US$ 95/kg since 2009. UNODC price monitoring shows that the cannabis price rise has developed in parallel with the opium price hike caused by the opium crop failure in 2010, making its per-hectare income similar to that of opium and thus financially very attractive to farmers. But because cannabis cultivation is less labour intensive — less weeding is involved and the extraction of "garda" (powdered cannabis resin) can be done at home in a matter of weeks with the help of family members instead of hired labour — it is actually more cost-effective than opium.

A lucrative sideline

Such advantages contribute to the status of cannabis as a lucrative cash crop. Yet the average area cultivated dropped from 0.4 ha (2009) to 0.29 ha (2011), thus although more households grew cannabis in 2011 they actually cultivated a smaller area than previously, while the per-hectare yield also decreased by 25 per cent from its 2009 level, especially for best quality resin. The increase in the number of households cultivating cannabis may mean that there are more, if smaller scale, cannabis growers who benefit from cannabis as a lucrative sideline on an opportunistic basis. Indeed, the majority of farmers interviewed do not grow cannabis every year, some grow every other year and some do so even less frequently. To a certain extent, the cultivation of cannabis in Afghanistan thus appears to be self limiting — but why?

Cannabis is a summer crop and the agricultural area available is much reduced in summer. Indeed, in the south, west and east of the country winter/spring cultivation is predominant, which is when most arable land is available. Cannabis needs irrigation water, which decreases with the arrival of summer and is only sufficient for a partial summer crop. Farmers have to balance different requirements, such as the provision of fodder for livestock, and have risk-minimizing strategies, meaning that they always grow some staple crops and hesitate to devote all their available land to just one crop. Cannabis has a long vegetation period lasting into October/November so no winter crop can be planted on a harvested cannabis field, which must then remain fallow, leading to a loss of income and all the subsequent ramifications.

[6] *World Drug Report, 2011* UNODC

The links between poppy and cannabis

A certain portion of farmers do not engage in cannabis cultivation at all because it is forbidden in Islam. The same is true for opium, which, while it is grown by many more households, on much more land and to a far greater extent, often co-exists with cannabis in Afghanistan. For example, commercial cannabis cultivation has shifted over the past half decade from the north to the more insecure south of the country and its cultivation is geographically associated with that of opium. Most cannabis-cultivating provinces also produced poppy in 2011 (15 out of 21 provinces), with the increase in cannabis-cultivating provinces since 2009 mainly being due to poppy provinces commencing commercial cannabis cultivation, to the extent that all major poppy-cultivating provinces also contained cannabis cultivation, while provinces free of poppy and cannabis continued to remain so. Furthermore, to a large extent those involved in cannabis and opium cultivation are actually the same people, even if opium growing households do not grow cannabis every year: in 2011, a large majority of cannabis farmers in Afghanistan (58%) also grew poppy, but only 6% of poppy farmers grew cannabis in that year. Moreover, many opium traffickers also trade in cannabis resin and there seems to be a striking correlation between opium and cannabis farm-gate prices, suggesting a considerable degree of market integration.

Another of the principal similarities between poppy and commercial cannabis cultivation is that households growing illicit crops have a much smaller share of remittances than non-growing households, meaning that one or more members of the household works abroad. Cannabis-growing households often do not have to send members abroad as they can earn the necessary cash component by growing cannabis. A similar pattern exists for poppy-growing households.

However, there are also some important differences between opium and cannabis production. For example, cannabis garda quality reportedly deteriorates after a couple of months so most farmers sell the complete harvest before that happens (represented by the strong post-harvest dip in prices in the months of January to March). Processing garda into hashish can increase storability but the process is time consuming and adds little value for farmers, who already make a tidy profit by producing garda. Opium, on the other hand, can be stored for years without losing quality, and can be used as a store of value (effectively a bank account), while cannabis, though undoubtedly an attractive cash crop, cannot.

The future

Another important difference between cannabis and poppy is that there is increasing Government pressure to eradicate poppy cultivation in Afghanistan whereas eradication of cannabis is not underpinned by systematic programmes for eradication and alternative development, nor by the support of financial donors. In addition, the associated lower cost of cannabis cultivation in comparison to poppy cultivation (estimated at 10% and 40% of gross income, respectively) makes it more profitable than opium. The possibility of the commercial production of cannabis gradually playing a much bigger role in the illicit Afghan economy, and eventually replacing opium, is unlikely, but still possible.

The huge disparity between the current size of areas under cultivation of the two drugs means that — even if that were possible — it would not happen in the short term, while the aforementioned environmental and agricultural limitations of cannabis cultivation would make it difficult. But shedding light on price trend coincidence between opium and cannabis farm-gate prices, cannabis trafficking and export, and cannabis cultivation in neighbouring countries would certainly help understand the future of commercial cannabis cultivation in Afghanistan.

Any policy aimed at reducing cannabis production in Afghanistan should, however, take into account the links between the two illicit crops and that there is a large pool of sporadic commercial cannabis farmers who may be prepared to cultivate cannabis more frequently should farm-gate prices remain high. The challenge to policymakers is to understand the decision-making process at the household level regarding the sporadic nature of cannabis cultivation and to develop strategies accordingly.

1 INTRODUCTION

This report presents the results of the third dedicated *Afghanistan Cannabis Survey* implemented by UNODC and the Ministry of Counter Narcotics (MCN). The first survey was carried out in 2009, as evidence from cannabis resin seizures had long pointed to Afghanistan as one of the world's main producers of the drug.

The 2011 cannabis survey covered the "cannabis risk area" in Afghanistan, i.e. 23 provinces in which commercial cannabis cultivation had been observed or reported in past surveys. Field information from the county's other 11 provinces indicated that cannabis cultivation either did not exist or was limited to kitchen gardens or other forms of small-scale, non-commercial cultivation, which are out of the scope of this research.

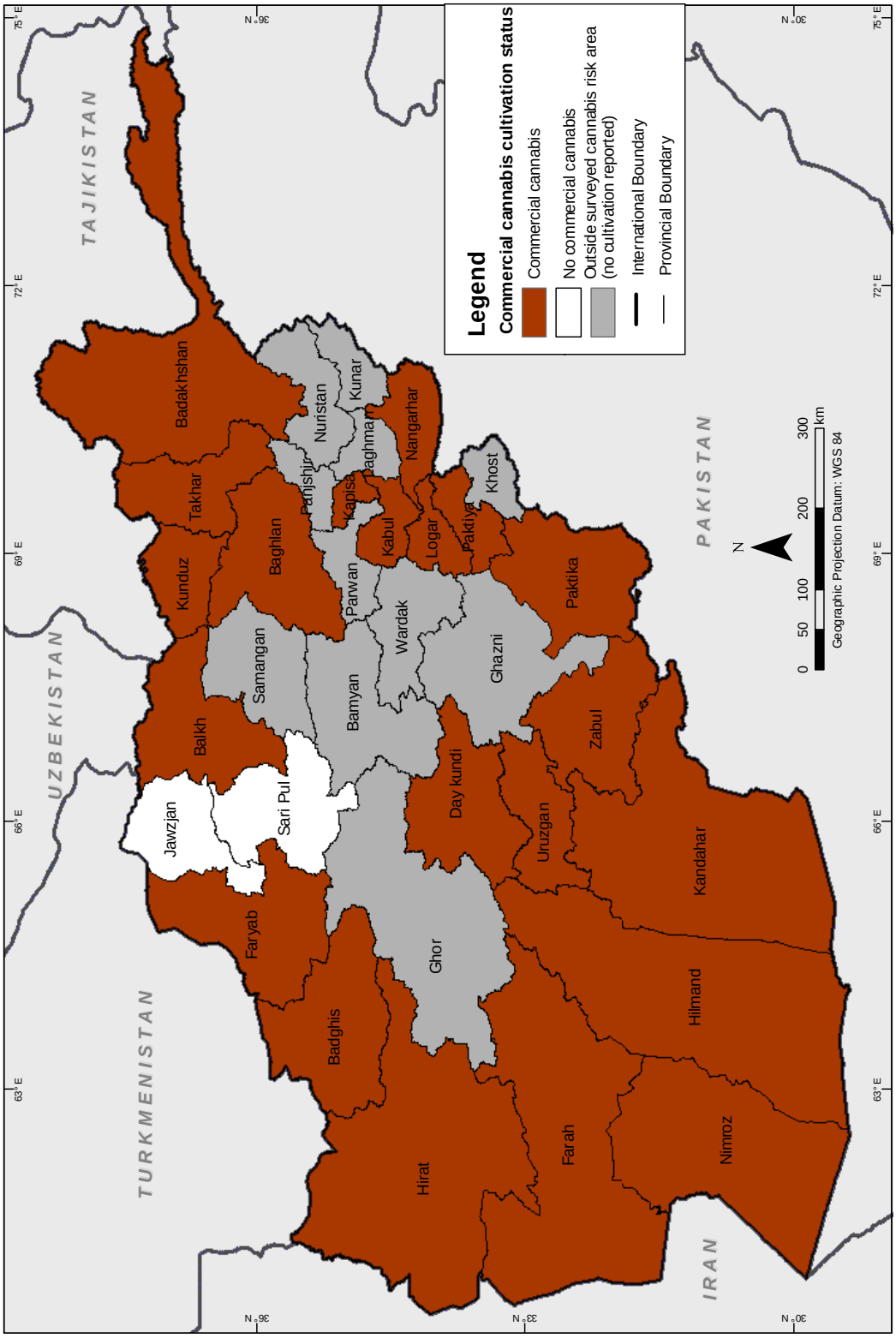
Based on the evidence gathered over three consecutive years and due to methodological improvements, in 2011, it was possible to provide point estimates for the area under cannabis cultivation, potential resin powder production, and the farm-gate value of production for the first time. In addition, it was possible to assess the production of cannabis from mixed-crop fields and on bunds around fields.

The survey consisted of village level interviews with farmers and headmen in over 1,500 villages, yield studies and satellite image interpretation. The main village survey with headmen and farmer interviews was implemented between July and September 2011. Cannabis resin yield was investigated through the information provided by headmen and farmers during the village survey and a yield observation study undertaken in December 2011-January 2012, when the processing of cannabis resin production took place. The overall cannabis area estimate is based on the interpretation of 155 very high-resolution satellite images and village survey estimation for the provinces not covered in satellite imagery.

The 2011 Survey of Commercial Cannabis Cultivation and Production has been implemented within the technical framework of UNODC's Illicit Crop Monitoring Programme (ICMP) under the project AD/AFG/F98. The objective of ICMP is to assist the international community in monitoring the extent and evolution of illicit crops within the context of the Political Declaration and Plan of Action on International Cooperation towards an Integrated and Balanced Strategy to Counter the World Drug Problem, adopted by Member States in 2009[7].

[7] E/2009/28, E/CN.7/2009/12, Political Declaration and Plan of Action on International Cooperation towards an Integrated and Balanced Strategy to Counter the World Drug Problem.

Map1: Commercial cannabis cultivation status, by province, 2011



Source: MCN - UNODC Afghanistan Cannabis Survey, 2011
Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

2 CANNABIS IN AFGHANISTAN 2011: FACTS & FIGURES

The scope of the survey

The 2011 cannabis survey covered the "cannabis risk area" in Afghanistan, which consists of 23 provinces where commercial cannabis cultivation had been observed or reported in past surveys. On the basis of reports and observations from regional and provincial survey coordinators it was concluded that in the other 11 provinces cannabis cultivation either did not exist or was limited to kitchen gardens or other forms of small-scale, non-commercial cultivation. To optimize the allocation of resources it was therefore decided to concentrate efforts on the 23 of the 34 provinces of Afghanistan that make up the cannabis risk area.

The main components of the survey were a socio-economic survey conducted in 1,509 villages in the risk area, which included interviews with village headman and individual interviews with three farmers per village. In addition to this "village survey", 155 high-resolution satellite images of 14 provinces were obtained and analysed. This "satellite survey" covered only fields with mono-crop cannabis but in some provinces cannabis is intercropped with licit crops, making the interpretation of satellite images and responses from farmers difficult. Such mixed fields, which do not show a typical cannabis reflectance pattern in images, cannot be identified with current remote-sensing methodology. Thus, the area estimate from the remote sensing survey refers only to mono-crop cannabis fields and does not consider cannabis in kitchen-gardens, along field boundaries and in mixed fields. Results from the village survey were used to complement the satellite survey estimates in provinces not covered by the satellite imagery.

The extent of commercial cannabis cultivation in 2011

The area under cannabis cultivation in Afghanistan in 2011 was estimated to be 12,000 ha (8,000 – 17,000 ha). Due to the experience gained in the preceding years, it was possible to provide a point estimate with a range for the first time. The results are therefore not directly comparable to the 2010 estimate, which was 9,000-29,000 ha, but lie well within its range.

The area estimate covers only fields with mono-crop cannabis and is therefore an estimate of large-scale, "commercial" production. That is to say that small-scale cultivation, such as in kitchen gardens, flower pots, along the walls of compounds, along the boundaries of fields, "wild cannabis" or cannabis inter-cropped with other crops in the same field at the same time, is not part of the area estimates of this survey.

In 21 out of 23 provinces in the cannabis risk area, the drug was found to be cultivated. Out of those 21 provinces, 14 were covered by high-resolution satellite images, while the remaining 7 provinces were covered by the village survey only (see table 1). The area estimate is a combined estimate for all 21 provinces (see Methodology section).

The survey found that roughly 40% of cannabis cultivation in 2011 was in the Southern region (a separate estimate cannot be provided because the survey was not designed for providing estimates with sufficient accuracy at the provincial level), a regional disparity that, by and large, reflects the current pattern of opium cultivation, though cannabis was also found in several poppy-free provinces. However, there is a clear geographic association between opium and cannabis cultivation at the provincial level.

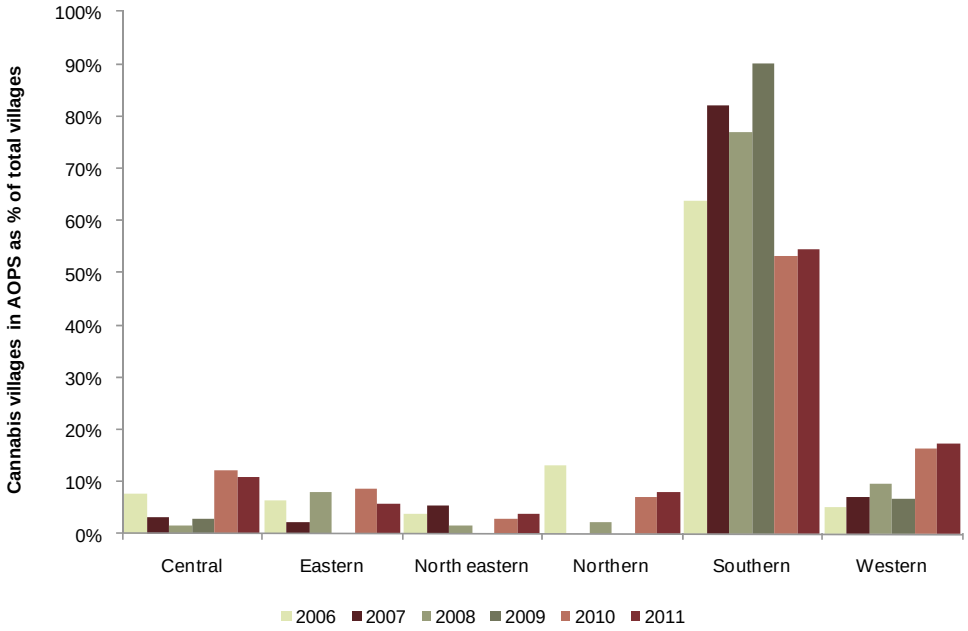
Regional trends in commercial cannabis cultivation

A dedicated annual survey for measuring the extent of cannabis cultivation and production in Afghanistan was undertaken by UNODC in each of the three years, 2009-2011. However, information on cannabis cultivation was also collected during the Annual Opium Surveys from 2005 to 2011 in which information was collected on farmers' intentions to cultivate cannabis in each of those years. Some information on trends over that period can be drawn from those sources, although there are some limitations. The village level interviews undertaken during the opium survey were conducted during the opium cultivation period (spring) before cannabis, a summer crop, was planted. Thus, reporting was based on farmers' intentions rather than actual cultivation as farmers could subsequently change their decision regarding summer cultivation. Furthermore, the existence of cannabis cultivation could not be verified by the surveyors during the opium surveys since the crop was not yet visible in fields. Given those limitations, an accurate area estimate of cannabis cultivation could not be made on the basis of interviews carried out during the opium poppy survey, but some conclusions can be drawn from it:

- During the period under review (2005-2011), the proportion of villages reporting cannabis cultivation was always much smaller than the proportion of opium-cultivating villages. Typically, the samples showed about two to four times more opium-cultivating than cannabis-cultivating villages.
- The lower proportion of cannabis-cultivating villages and the smaller area of cannabis cultivated per village compared to opium cultivation, indicate that the level of cannabis cultivation in the years 2005 to 2011 was well below the level of opium cultivation in the same period.
- The proportion of villages in the sample reporting cannabis cultivation in the Southern region dramatically increased between 2005 and 2009 and slightly decreased in 2010 and 2011. The number of cannabis-cultivating villages in the Northern region decreased between 2005 and 2009, and slightly increased in 2010 and 2011. Due to the low number of cannabis villages found in all of those years, it is difficult to assess whether such proportional changes indicate a change in cannabis cultivation in absolute terms in those regions.

The information on cannabis collected through the Annual Opium Surveys cannot be directly compared with the information collected during the three cannabis surveys as the opium surveys cover all provinces of Afghanistan, whereas the cannabis surveys cover only provinces identified as the cannabis risk area. In addition, only a small proportion of villages included in the opium surveys reported cannabis cultivation and that limited the reliability of the information collected on cannabis.

Figure 1 Regional shares of cannabis-growing villages, 2006-2011



Source: MCNUNODC: Annual Opium Surveys 2006-2011

Table 1: Commercial cannabis cultivation by province, 2009 - 2011

PROVINCE	Cannabis cultivation 2009	Cannabis cultivation 2010	Cannabis cultivation 2011
Kabul***	Not in risk area*	Not in risk area*	Yes
Khost	Not in risk area*	Yes	Not in risk area*
Logar**	Yes	Yes	Yes
Paktya**	Yes	Yes	Yes
Panjshir	Not in risk area*	Not in risk area*	Not in risk area*
Parwan	Not in risk area*	Not in risk area*	Not in risk area*
Wardak	Not in risk area*	Not in risk area*	Not in risk area*
Ghazni	Not in risk area*	Not in risk area*	Not in risk area*
Paktika***	Not in risk area*	Not in risk area*	Yes
Central Region	**Yes**	**Yes**	**Yes**
Kapisa***	Not in risk area*	Not in risk area*	Yes
Kunar	Not in risk area*	Not in risk area*	Not in risk area*
Laghman	Not in risk area*	Not in risk area*	Not in risk area*
Nangarhar**	Yes	Yes	Yes
Nuristan	Not in risk area*	Not in risk area*	Not in risk area*
Eastern Region	**Yes**	**Yes**	**Yes**
Badakhshan**	Yes	Yes	Yes
Takhar***	Yes	Yes	Yes
Kunduz***	No	Yes	Yes
North-eastern Region	**Yes**	**Yes**	**Yes**
Baghlan**	Yes	Yes	Yes
Balkh**	Yes	Yes	Yes
Bamyan	No	No	Not in risk area*
Faryab***	Insignificant	Yes	Yes
Jawzjan***	Yes	No	No
Samangan	Not in risk area*	Not in risk area*	Not in risk area*
Sari Pul***	No	No	No
Northern Region	**Yes**	**Yes**	**Yes**
Hilmand**	Yes	Yes	Yes
Kandahar**	Yes	Yes	Yes
Uruzgan**	Yes	Yes	Yes
Zabul**	Yes	Yes	Yes
Day Kundi**	Not in risk area*	Yes	Yes
Southern Region	**Yes**	**Yes**	**Yes**
Badghis***	Yes	Yes	Yes
Farah**	Yes	Yes	Yes
Ghor	Not in risk area*	Not in risk area*	Not in risk area*
Hirat**	Yes	Yes	Yes
Nimroz**	Yes	Yes	Yes
Western Region	**Yes**	**Yes**	**Yes**
Total (rounded)	**10,000-24,000**	**9,000-29,000**	**12,000**

** Provinces not in the cannabis risk area as defined for the cannabis survey of the given year.*

*** Estimates 2011 based on satellite images. *** Estimates 2011 based on village survey.*

Geographical distribution of commercial cannabis and opium cultivation

As in 2009 and 2010, most commercial cannabis cultivation in 2011 occurred in the Southern region, where most opium cultivation (78%) was also found. Cannabis was cultivated in all five Southern provinces (Day Kundi, Hilmand, Kandahar, Uruzgan, and Zabul) and there is a clear geographical association between opium and cannabis cultivation at the provincial level. That association exists at a household level, too, with almost two thirds of cannabis-growing households (58%) also reporting poppy cultivation in the preceding season.

Table 2: Cannabis and opium cultivation status, 2010 vs. 2011, by number of provinces (34 provinces)

Illicit cultivation status	2009	2010	2011
Cannabis only	7	8	6
Opium poppy only	10	3	2
Cannabis and opium poppy	4	11	15
Neither cannabis nor opium poppy	13	12	11

Note: Provinces with less than 100 ha of poppy cultivation are considered to be "poppy-free". For cannabis, no such threshold was applied as only commercial production was considered.

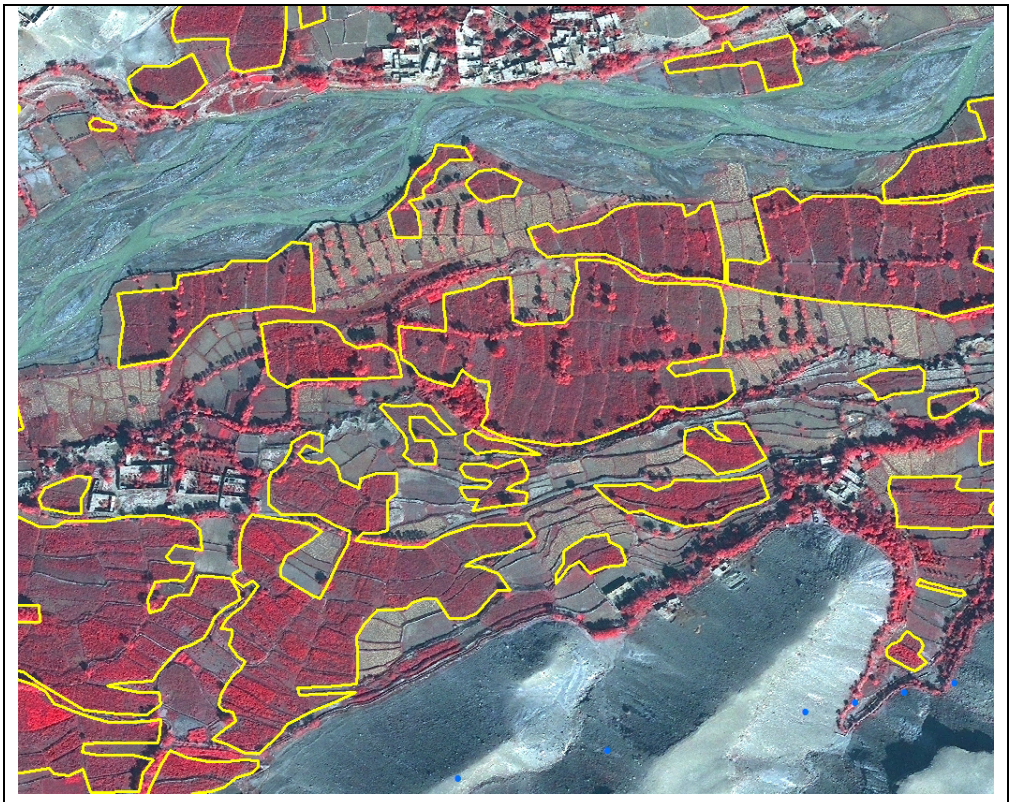
Photo 1: Cannabis field at flowering stage in Sherzad district of Nangarhar province, 2011

Table 3: Cannabis and opium cultivation, by province, 2011

PROVINCE	Opium cultivation 2011 (ha)**	Commercial cannabis cultivation 2011
Kabul	220	Yes
Khost	Poppy-free	Not in risk area*
Logar	Poppy-free	Yes
Paktya	Poppy-free	Yes
Panjshir	Poppy-free	Not in risk area*
Parwan	Poppy-free	Not in risk area*
Wardak	Poppy-free	Not in risk area*
Ghazni	Poppy-free	Not in risk area*
Paktika	Poppy-free	Yes
Central Region	**220**	**Yes**
Kapisa	181	Yes
Kunar	578	Not in risk area*
Laghman	624	Not in risk area*
Nangarhar	2,700	Yes
Nuristan	Poppy-free	Not in risk area*
Eastern Region	**4,082**	**Yes**
Badakhshan	1,705	Yes
Takhar	Poppy-free	Yes
Kunduz	Poppy-free	Yes
North-eastern Region	**1,705**	**Yes**
Baghlan	161	Yes
Balkh	Poppy-free	Yes
Bamyan	Poppy-free	Not in risk area*
Faryab	145	Yes
Jawzjan	Poppy-free	No
Samangan	Poppy-free	Not in risk area*
Sari Pul	Poppy-free	No
Northern Region	**305**	**Yes**
Hilmand	63,307	Yes
Kandahar	27,213	Yes
Uruzgan	10,620	Yes
Zabul	262	Yes
Day Kundi	1,003	Yes
Southern Region	**102,405**	**Yes**
Badghis	1,990	Yes
Farah	17,499	Yes
Ghor	Poppy-free	Not in risk area*
Hirat	366	Yes
Nimroz	2,493	Yes
Western Region	**22,348**	**Yes**
Total (rounded)	**131,000**	**12,000**

** Provinces not in the cannabis risk area as defined for the 2011 cannabis survey.*
*** See Afghanistan Opium Survey 2011, UNODC and MCN Afghanistan. Provinces with less than 100 ha of poppy cultivation are considered to be "poppy-free".*

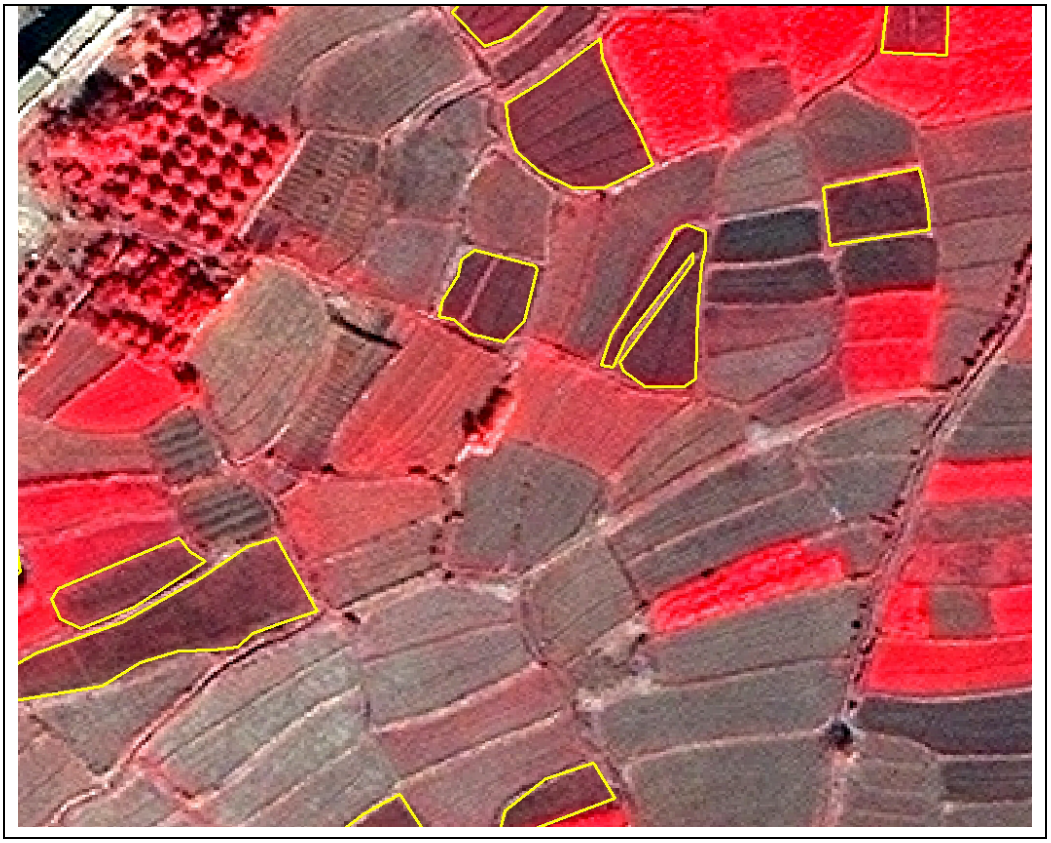
Photo 2: Cannabis fields at the flowering stage, as seen on a false-colour satellite image in Nangarhar province, 2011



Cannabis fields at the flowering stage, as seen on a false-colour satellite image

Cannabis fields at the flowering stage, as seen on heli-picture

Photo 3: Cannabis at the flowering stage, Ahmad Abad district, Paktya province, 2011



Cannabis yield and potential production

The product sold by cannabis farmers is a powdery substance called "garda" obtained by threshing and sieving dried cannabis plants. In a process of repeated sieving, farmers produce graded qualities that contain different concentrations of cannabis resin (first, second and third garda). Research indicates that regional differences exist in processing cannabis into garda, which are also reflected in the prices of its different qualities (see also section on Afghanistan Cannabis Agriculture).

The 2009 and 2010 surveys showed that in the Northern and North-eastern region processing methods used to result in a better quality but smaller quantity of first garda, whereas in the Southern, Eastern, Western and Central regions a larger proportion of first garda was obtained but of a poorer quality (less resin and more other plant material). Garda from the Northern and North-eastern regions (Mazari or Balkhi garda) contained more resin and no cannabis leaves, in contrast to garda from other regions where farmers mixed the resin with cannabis leaves during the processing of first garda. Different qualities of garda are also reflected in different prices since the higher its resin content, the higher the price that garda fetches.

In 2011, the regional differences in garda yield and quality were much less pronounced than in 2009 and 2010. That could be due to a change in garda processing in the Northern region, where the best first garda quality was previously produced. Towards the end of 2011, price monitoring reports indicated that the quality of first garda from Balkh (Northern region) was lower than usual, which was also reflected in lower prices. Thus, yield data no longer show big regional differences in garda quality, but in order to maintain consistency the same yield regions were used in the 2011 survey as in the two preceding cannabis surveys. If the reported change in the pattern of regional garda quality continues, the current yield regions may be revised in subsequent surveys.

For the same reasons of consistency the provinces also continue to be grouped into a Northern/North-eastern (N/NE) region and a Southern, Eastern, Western and Central (S-E-W-C) region.

Table 4: Average cannabis garda yield, by region (kg/ha), 2011

Region	1st garda (kg/ha)	2nd garda (kg/ha)	3rd garda (kg/ha)	Total yield (kg/ha)
N/NE (n=21)	47	35	32	113
S-E-W-C (n=26)	52	36	23	111
Weighted average*	**51**	**36**	**25**	**112**

** Weighted by cannabis area, n refers to number of surveyed fields.*

The village survey showed that cannabis cultivation on the boundaries of fields and mixed-crop cultivation in the same field occurred almost exclusively in the Central and Eastern region. Due to the nature of those cultivation methods the estimate of a per-hectare yield did not seem to be useful and the production estimates for those types of cultivation were not calculated by multiplying the area estimate with the yield estimate, but rather by using an estimate of the number and size of fields with cultivation on boundaries and mixed-crop cultivation for estimating total production. The share of garda produced by those methods was revealed to be relatively small, amounting to about 2% of total production.

Table 5 shows estimates of potential garda production in the Northern and North-eastern region, the other regions and for mixed-crop cultivation and cultivation on bunds. As a reference, the 2010 production estimate was 1,200-3,700 tons.

Table 5: Potential commercial cannabis resin garda production, 2011

	1st garda (tons)	2nd garda (tons)	3rd garda (tons)	Rounded total (tons)	2010 rounded (tons)
N/NE	116	86	79	281	
S-E-W-C	471	329	212	1012	
Mixed-crop/bunds	10	6	4	20	
Total production	597	421	295	**1,300 (1,000-1,900)**	1,200-3,700

Cannabis prices

Farm-gate prices of cannabis garda

Differences in the farm-gate price of cannabis resin (garda) reflect different garda qualities and regional differences. Prices reported by farmers during the survey are referred to as first, second and third garda.

Since most farmers sell their cannabis garda soon after harvest (in January), the January 2012 prices reported through the monthly price monitoring system were used to calculate farmers' income and the farm-gate value of cannabis production in 2011.

The national estimate presented was calculated by taking the average price weighted by production in each respective region. That average therefore represents the average "value" of 1 kg of each type of garda.

Table 6: Farm-gate prices of cannabis resin (garda), by region (US$/kg), January 2012

Region	1st garda (US$/kg)	2nd garda (US$/kg)	3rd garda (US$/kg)
N/NE*	170	108	64
S-E-W-C *	77	51	30
Average (weighted) **	**95**	**63**	**39**

** Simple average of provincial averages in this region. ** Average weighted by estimated cannabis production.*

Source: First garda prices: MCN/UNODC monthly price monitoring report, January 2012. Second and third garda prices: own calculations based on the cannabis survey 2011.

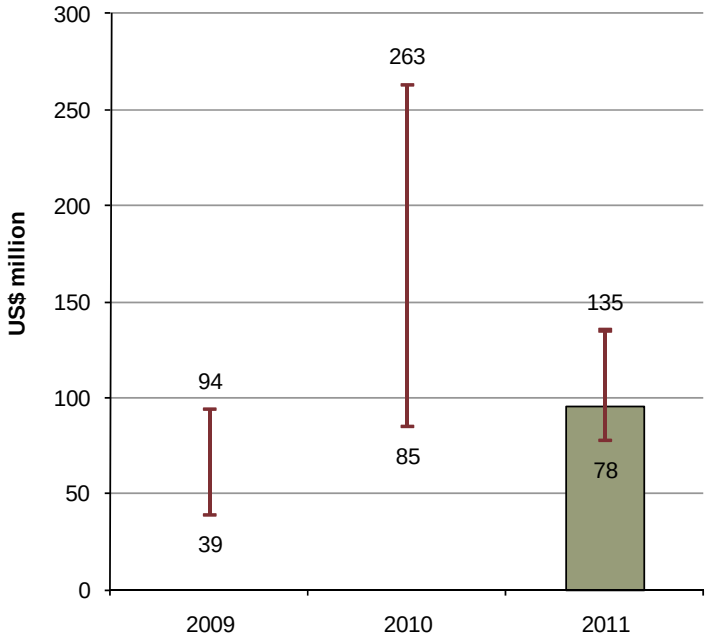
Farm-gate value of commercial cannabis resin production

The farm-gate value of commercial cannabis garda production in Afghanistan was calculated on the basis of production estimates and farm-gate price calculations. The total farm-gate value of cannabis resin (garda) in 2011 was US$ 95 million (US$ 78-135 million) and corresponded to 0.6% of the licit GDP of Afghanistan in that year.

Table 7: Farm-gate value of commercial cannabis production (US$ million), 2010 and 2011

	1st garda (US$million)	2nd garda (US$million)	3rd garda (US$million)	Total (US$)	Total (US$) 2010
Farm-gate value	57	26	12	95 (78-135)	85-263

Figure 2 Farm-gate value of cannabis resin (US$ million), 2009-2011



Note: The bars indicate the upper and lower bound of the estimation range.

Source: MCN/UNODC Afghanistan Cannabis Survey 2009, 2010.

3 SOCIO-ECONOMIC FACTORS OF CANNABIS CULTIVATION

The scope of the survey

The cannabis village survey more specifically targets the cannabis risk area and collects information at the time when cannabis is cultivated. All results are based on interviews with farmers and village headmen conducted by specially trained surveyors.

Cannabis growing households

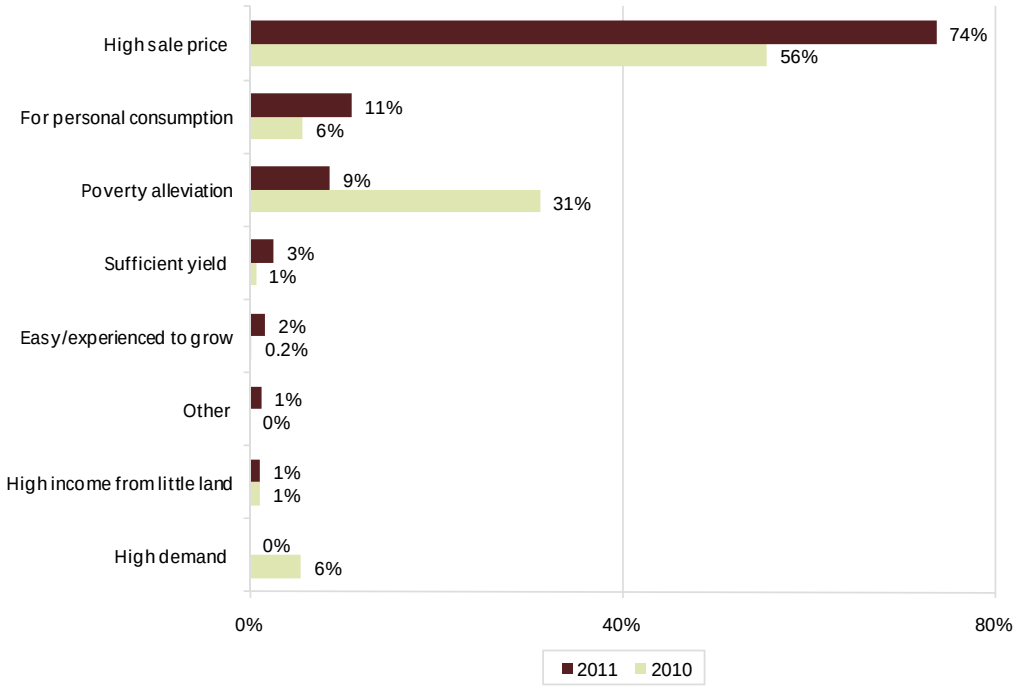
Based on headmen interviews, the number of cannabis-growing households in Afghanistan in 2011 was estimated at 65,000 households,[8] an increase of 38% on 2010 (47,000 households). Since the number is based on headmen interviews it may also include households growing on a small-scale such as in kitchen gardens.

The average cannabis area cultivated per household is based on headmen interviews. At 0.29 ha the average area in 2011 was lower than the 2010 average of 0.33 ha, thus, while there were more cannabis cultivating households in 2011, on average, each household cultivated a smaller area of cannabis.

Self-reported reasons for cannabis cultivation

Cannabis-cultivating farmers were asked about the most important reasons why they cultivate cannabis. The most frequently reported reason in 2011 was the high sales price of cannabis (74%), followed by personal consumption and poverty alleviation (11% and 9%, respectively). The large increase in the proportion of farmers mentioning "High sale price" as their main reason for cultivating cannabis in 2011 in comparison to in 2010 reflects the increase in the cannabis price.

Figure 3: Reasons for cultivating cannabis in 2010 and 2011 (n = 410 farmers)



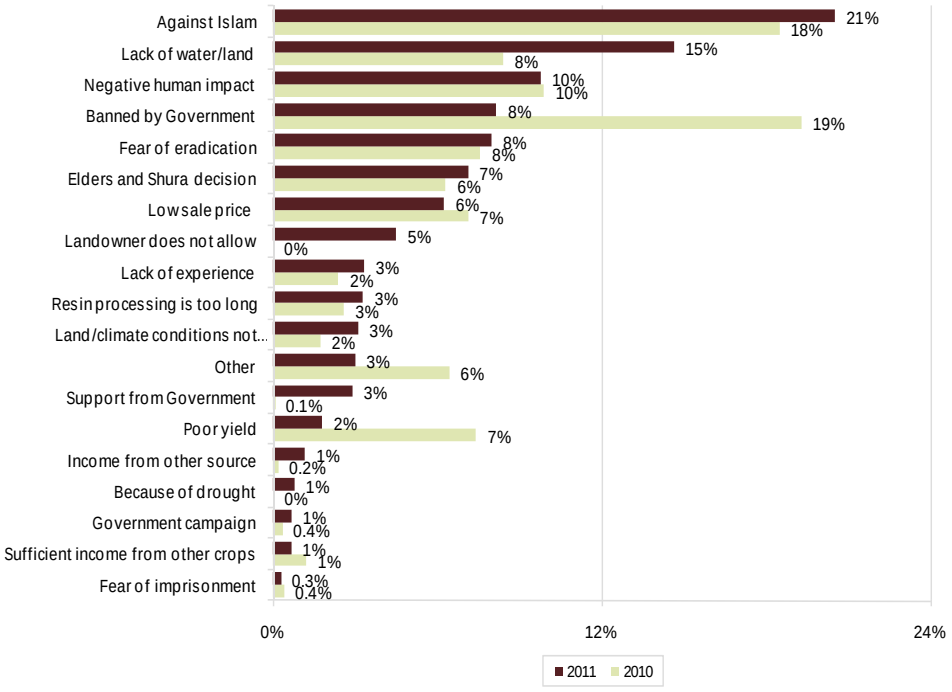
[8] This estimate was calculated based on the village frame that is used for inferring from a ratio estimate to the total estimated number. When looking at the village data some inconsistencies appear. The explanation of origin or clarification of inconsistencies is beyond the scope of this report, but they should be borne in mind when interpreting results from the village survey. For a discussion on the village frame see the Methodology section.

Reasons for ceasing cannabis cultivation

Like opium poppy, cannabis is an illicit crop in Afghanistan and the possession of cannabis products is illegal. Many farmers who had ceased cannabis cultivation in or before 2011 reported that they had not cultivated cannabis in 2011 because it is forbidden (haraam) in Islam (21%). The other important reasons were lack of water and/or land (15%), its negative impact on human beings (10%) and because it is banned by the Government (8%). Other reasons included fear of eradication, decisions of elders and Shura, low sale price, resin processing is too long, unsuitable land and climate conditions, lack of experience, and sufficient income from other crops or sources.

In 2011, a much smaller proportion of farmers than in 2010 mentioned the Government ban on cannabis cultivation as their main reason for having ceased cultivation.

Figure 4: Reasons for ceasing cannabis cultivation in or before 2011 (n = 696 farmers)



Replacement of cannabis income reported by farmers who ceased cannabis cultivation

Farmers who used to cultivate cannabis but ceased cannabis cultivation in or before 2011 were asked what they did to compensate for their lost income from cannabis. About 64% reported that they cultivated other crops, 16% that they were involved in off-farm employment and 9% that they were involved in business. Income from livestock accounted for 4% of respondents, cope with situation for 3% and receiving money from abroad for 2%, while only 1% of farmers reported that they replaced their cannabis income by cultivating opium poppy.

Figure 5: Replacement of cannabis income reported by farmers who ceased cannabis cultivation in or before 2011 (n = 704 farmers)

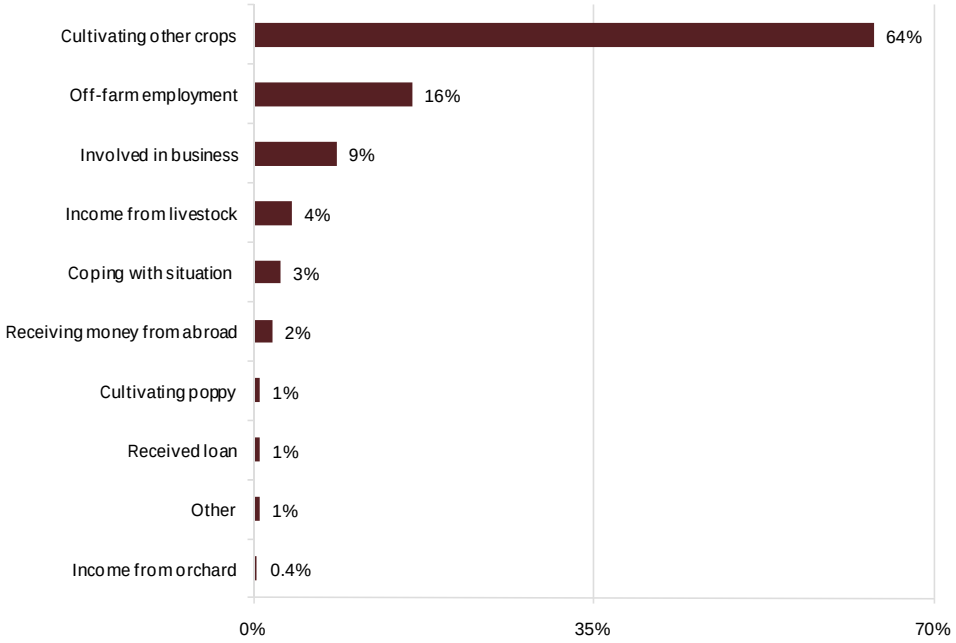


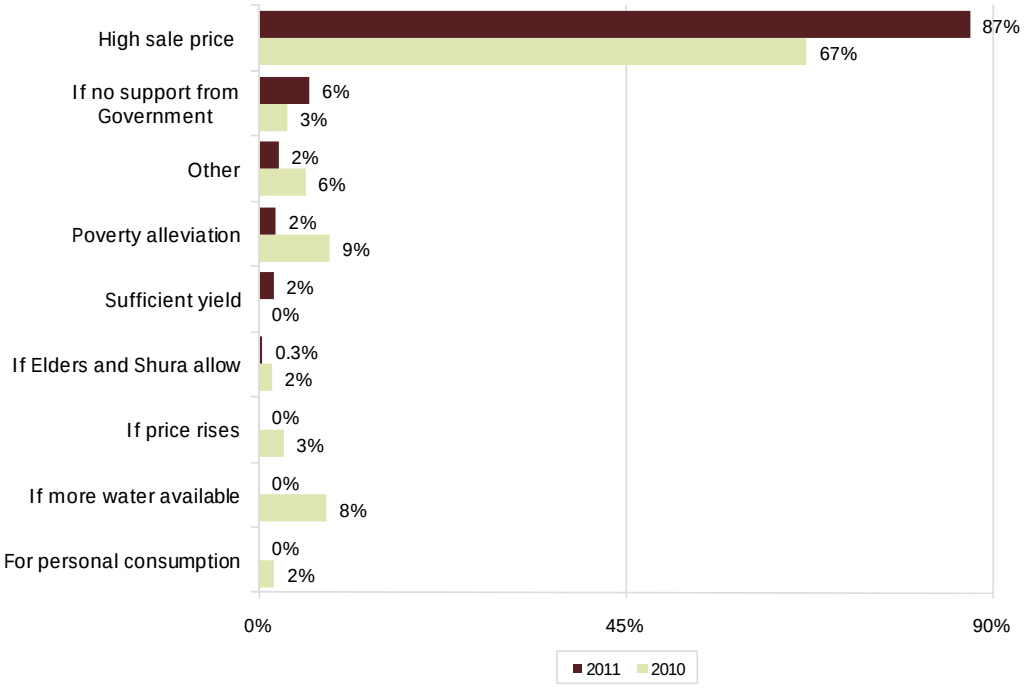
Photo 4: Mature female cannabis plant with resin glands

Mature female cannabis plant with buds cultivated in Northern Afghanistan

Conditions for potentially resuming cannabis cultivation in future

Those farmers who ceased cannabis cultivation were asked under what conditions they would recommence its cultivation. Only 13% of all farmers responded that they would grow cannabis again in future, with the main reason for doing so being its high sale price (87%). Few farmers (6%) responded that they would grow cannabis again if they received no support from the Government, while only (2%) of farmers reported that they would recommence cannabis cultivation because of poverty.

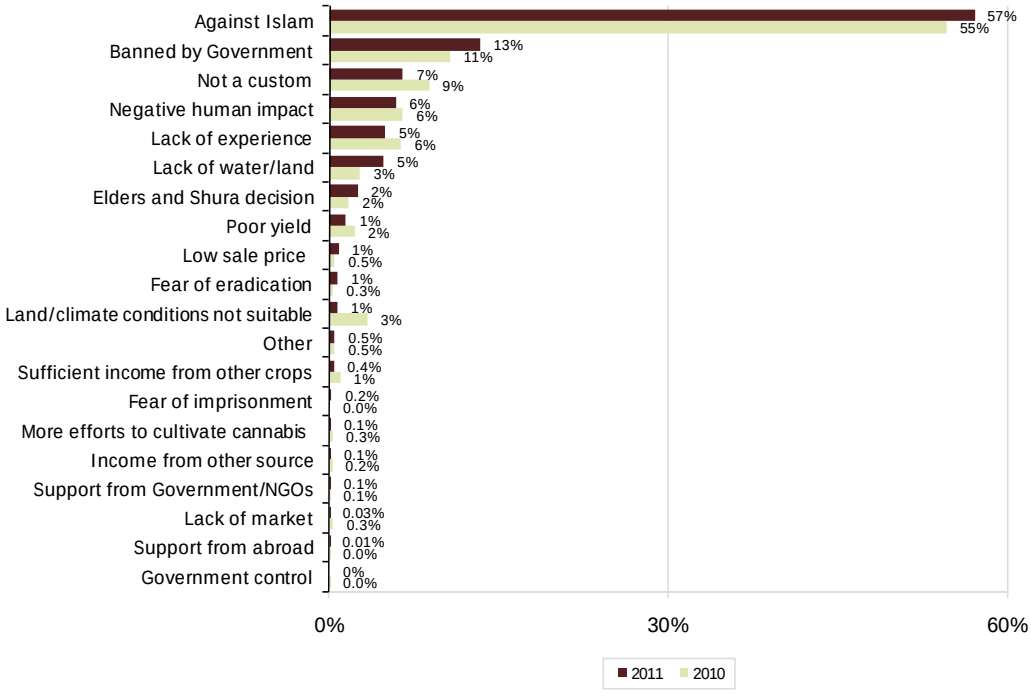
Figure 6: Conditions for potentially resuming cannabis cultivation in future, reported by farmers who ceased cultivation (n = 90 farmers)



Reasons for never cultivating cannabis

Farmers who had never grown cannabis were asked for the most important reasons why they had never done so. The most frequently mentioned reason for never growing cannabis by those questioned in 2011 was that it is forbidden in Islam (57%). The second most frequently mentioned reason was the Government ban on cannabis cultivation (13%), followed by the negative impact of cannabis on human beings (7%) and because it is not a custom (6%). In addition, farmers said they had never grown cannabis because of their lack of experience (5%), lack of water and/or land on which to cultivate cannabis (5%), the decision made by elders and Shura (2%) and poor yield (1%).

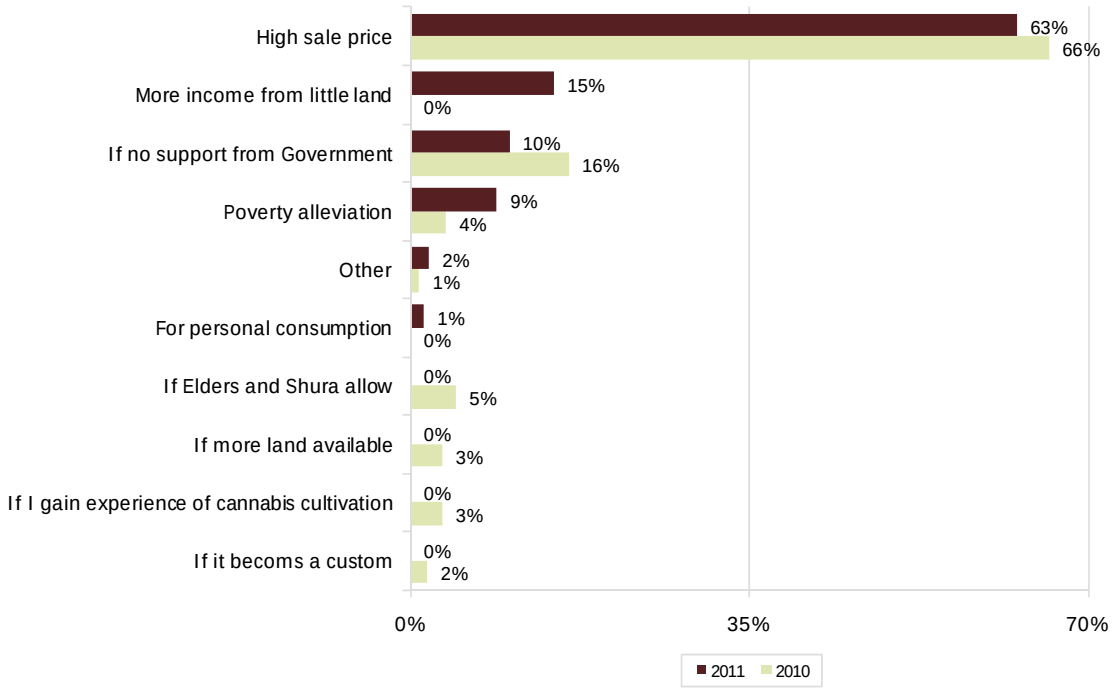
Figure 7: Reasons for never cultivating cannabis (n = 3,403 farmers)



Conditions that would lead farmers who had never grown cannabis to start cultivating it

Farmers who had never grown cannabis were asked under what conditions they would start cultivating cannabis. They included the high sale price of cannabis (63%), more income from little land (15%), if there was a lack of support from the Government (10%) and poverty alleviation (9%). Few farmers reported that they would start cannabis cultivation for personal consumption.

Figure 8: Reasons for potentially cultivating cannabis in future, reported by farmers who had never grown cannabis (n = 47 farmers)



Characterizing cannabis-growing villages

Cannabis cultivation is strongly related to agricultural assistance and access to facilities

When comparing cannabis-free villages with cannabis-cultivating villages several differences can be noted. Testing for statistical significance reveals that certain facilities (such as schools) are more likely to be found in villages without cannabis cultivation than in villages with cannabis cultivation.

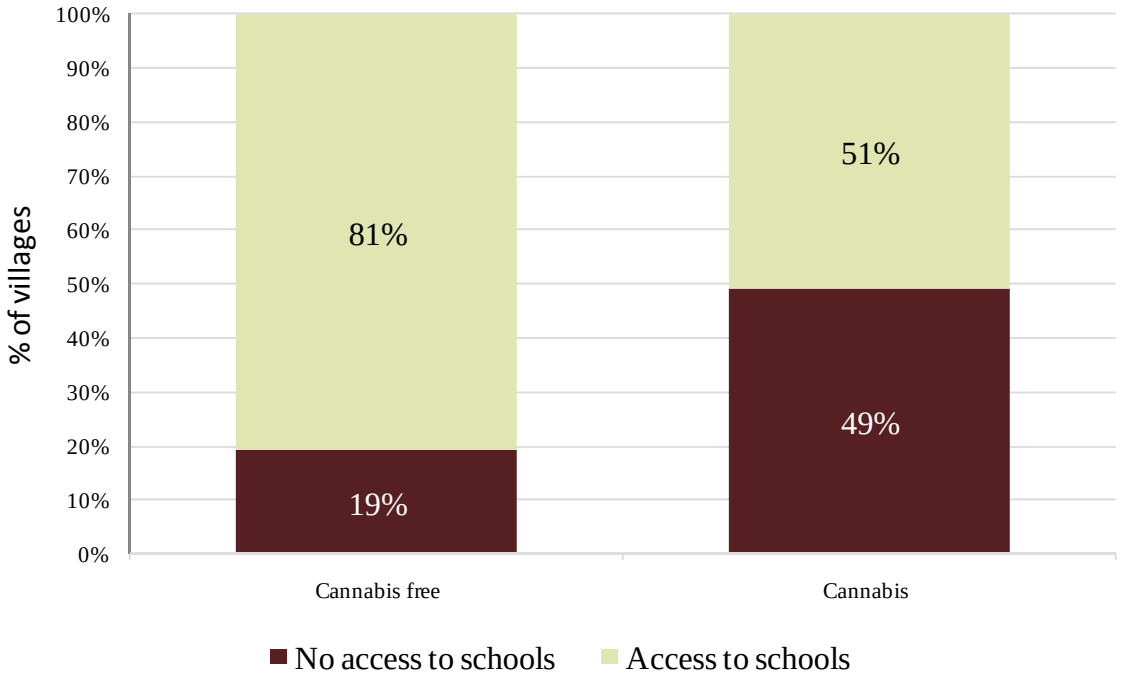
All village headmen were interviewed on the status and availability of basic development facilities in their villages.[9] Information was gathered about access to credit, electricity, irrigation, markets for agricultural products, medical facilities, off-farm employment opportunities, telephones, drinking water, road and transportation, school, vocational skills training and access to TV/radio.

According to the information provided by headmen, about (49%) of all villages surveyed had no access to credit, electricity, markets for agricultural products, off-farm employment opportunities and vocational skills training, while 39% of villages had access to drinkable water, irrigation water, road and transportation, school and TV/radio, 68% of villages had access to telephones and less than half of villages had access to a medical centre.

Statistically, a significant correlation exists between access to schools and the absence of cannabis, a connection that was already established in the 2010 cannabis survey. One of the most interesting discoveries of the 2011 survey is the correlation between cannabis and irrigation, which shows that villages with access to irrigation are more likely to grow cannabis than villages without it. This could be due to the fact that cannabis is more likely to be grown in summer when water is scarce and irrigation necessary.

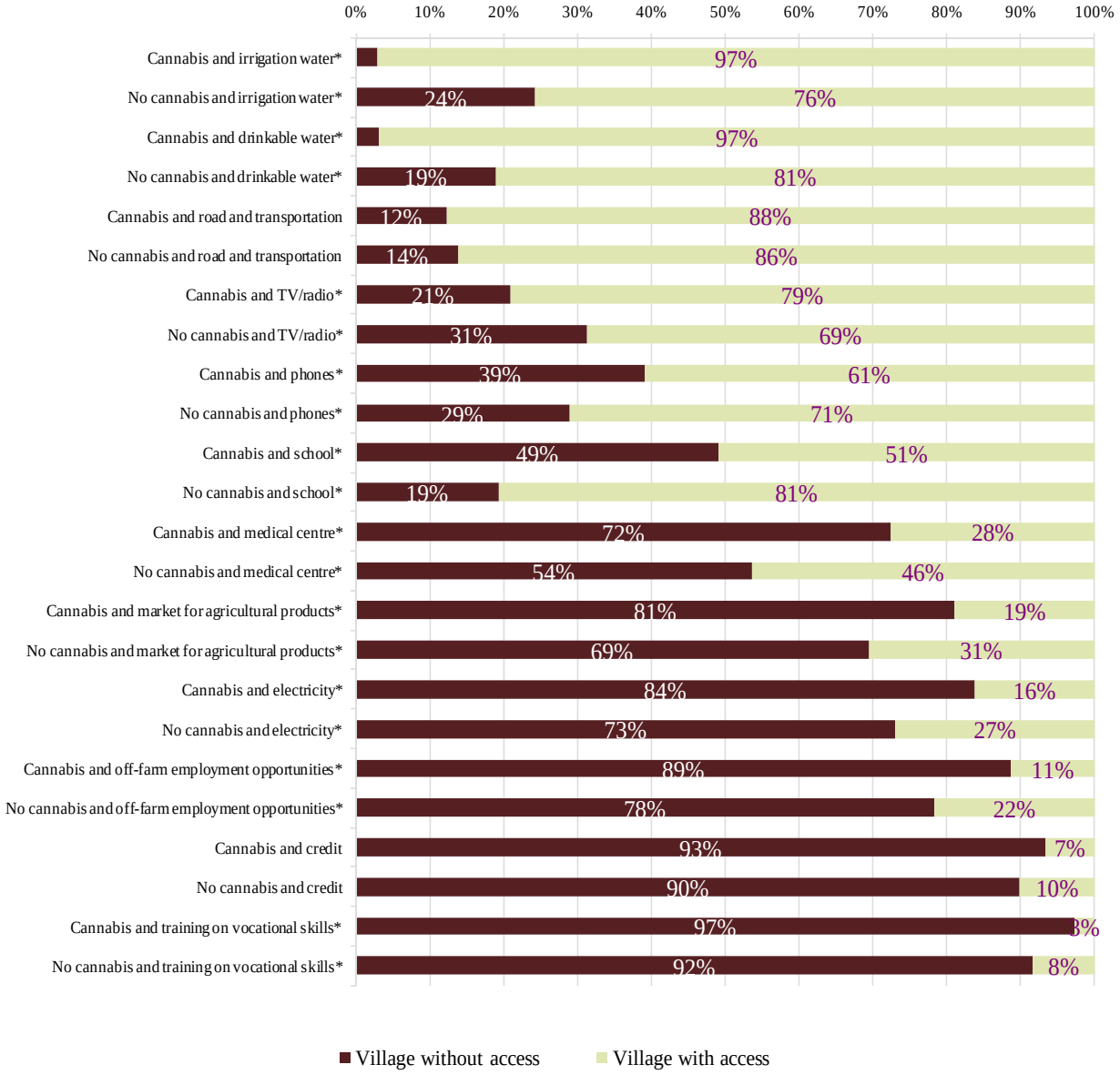
However, even if access to certain facilities is more common in cannabis-free villages, the role played by other explanatory factors (e.g. centrality) cannot be excluded.

Figure 9: Access to schools in the cannabis risk area, by cannabis growing status, 2011



[9] Surveyors did not formally verify the information provided by headmen or farmers.

Figure 10 Access to certain facilities in cannabis-growing villages and cannabis-free villages, 2011



Note: Each first bar shows the percentages of villages with access and without out access among cannabis growing villages; the second bar shows the percentages among cannabis free villages.

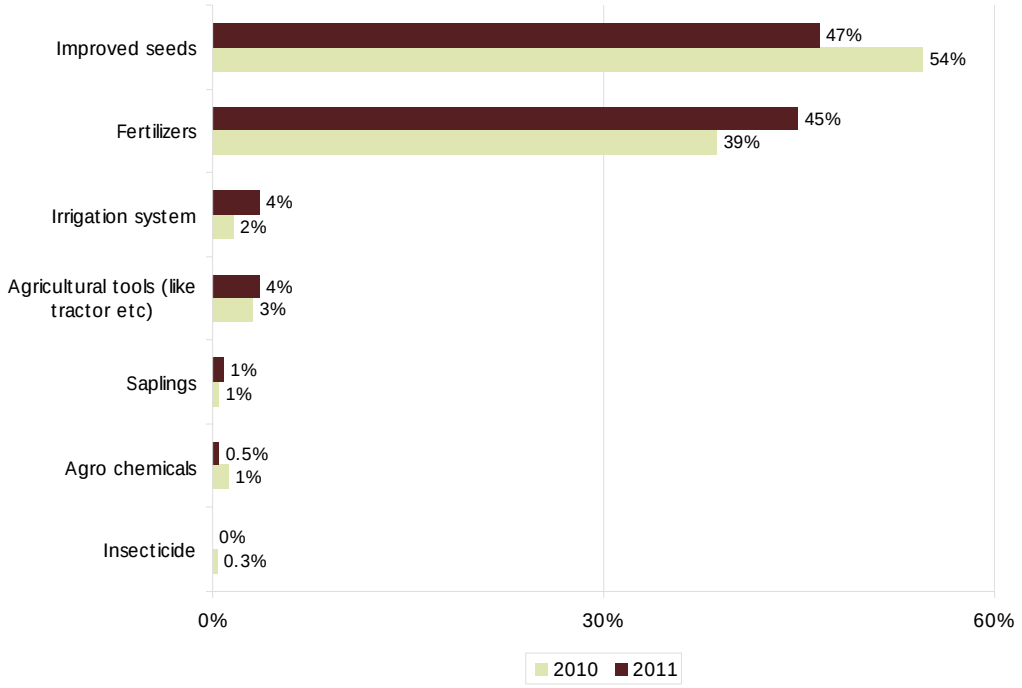
** The Chi-square statistic is significant at the 0.05 level, which means that the difference between cannabis-growing and cannabis-free villages is significant.*

Agricultural assistance reduces the likelihood of cannabis cultivation

The association between cannabis cultivation and a lack of agricultural assistance was statistically significant and suggested that, at the village level, the provision of agricultural assistance may have influenced the decision to cultivate cannabis in 2011. Villages that received some kind of agricultural assistance were less likely to grow cannabis than villages that did not, but other factors may also have played a role. For instance, the security situation may influence the delivery of agricultural assistance, particularly in the Southern region where most cannabis cultivation occurs, but whether or not there is a causality needs to be determined by other means.

Less than half of villages in the cannabis risk area (35%) reported having received agricultural assistance and types of assistance varied. They included improved seeds (47%), fertilizers (45%), agricultural tools such as tractors (4%), and irrigation system improvements such as karez and stream cleaning, dam construction or well digging (4%). Support in the form of agro-chemicals and saplings were minimal.

Figure 11: Types of agricultural assistance received in 2011, reported by headmen (n=529 villages)



The role of cannabis in the household economy

Farmers cultivate cannabis infrequently, but do so more often in the South

In the village survey, farmers who grew cannabis in 2011 (n=417) were asked if and in which years they cultivated cannabis in the preceding five years (since 2006). Only a small proportion of farmers (4%) were new cannabis farmers, meaning that they had commenced cannabis cultivation in 2011. Just over half of cannabis farmers (51%) had cultivated cannabis, on average, every second year or less in the period in question. Less than a third of farmers (32%) cultivating cannabis in 2011 reported cannabis cultivation in most of those years but only (14%) had cultivated it in every year of the observation period (2006-2011).

Farmers in the Southern region who cultivated cannabis in 2011 cultivated cannabis during the six year observation period more frequently than those in the other regions of Afghanistan, with 44% of them also growing cannabis in three or four other years between 2006-2011, while in the other regions the figure was only 14%. About 35% of farmers in the Southern region had also cultivated cannabis in 2011 as well as in one or two other years between 2006-2011, while that was true also for over two thirds (74%) of farmers in other regions.

Figure 12: Cannabis cultivation frequency in 2006 to 2011 of cannabis-cultivating farmers in 2011 (n=417 farmers)

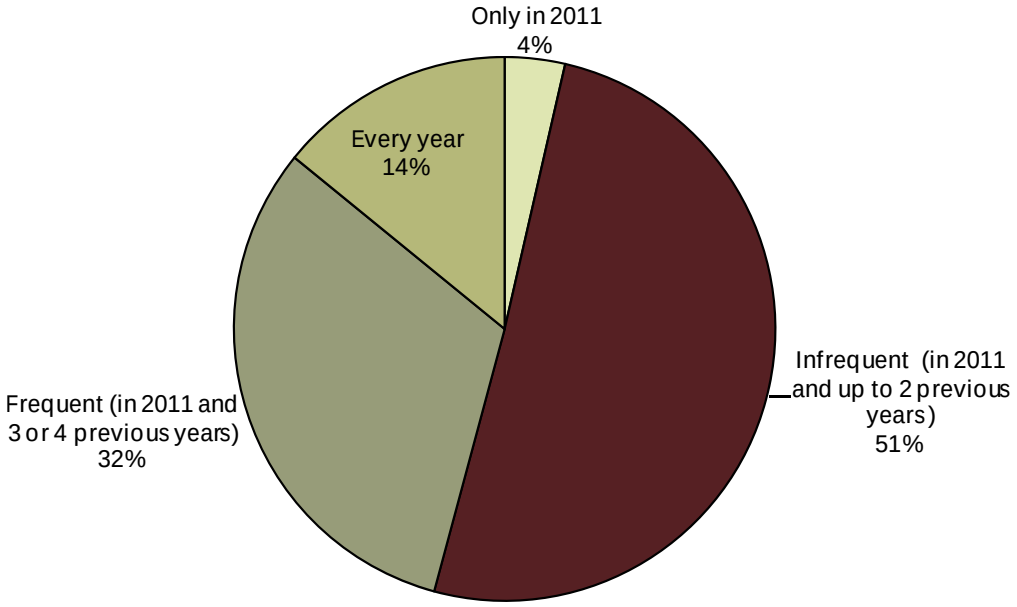


Figure 13: Years of cannabis cultivation between 2006 and 2011, reported by cannabis-growing farmers in 2011 (n=417 farmers)

Commercial cannabis farmers are also poppy farmers

Previous reports on cannabis and opium poppy cultivation have shown a clear connection between growing opium poppy and cannabis, both at the household and village level. The 2011 cannabis village survey shows that almost 58% of cannabis-growing households also cultivated poppy in the preceding season. In the Southern (69%) and Western regions (67%) it was even more pronounced, with almost seven out of ten cannabis farmers also cultivating opium poppy.

The connection was also very obvious at the village level: in 51% of all poppy-cultivating villages (*Opium Survey 2011*) cannabis was also grown, whereas only 5% of non-poppy-cultivating villages cultivated cannabis. It is therefore safe to say that the majority of cannabis-cultivating households are involved in poppy cultivation.

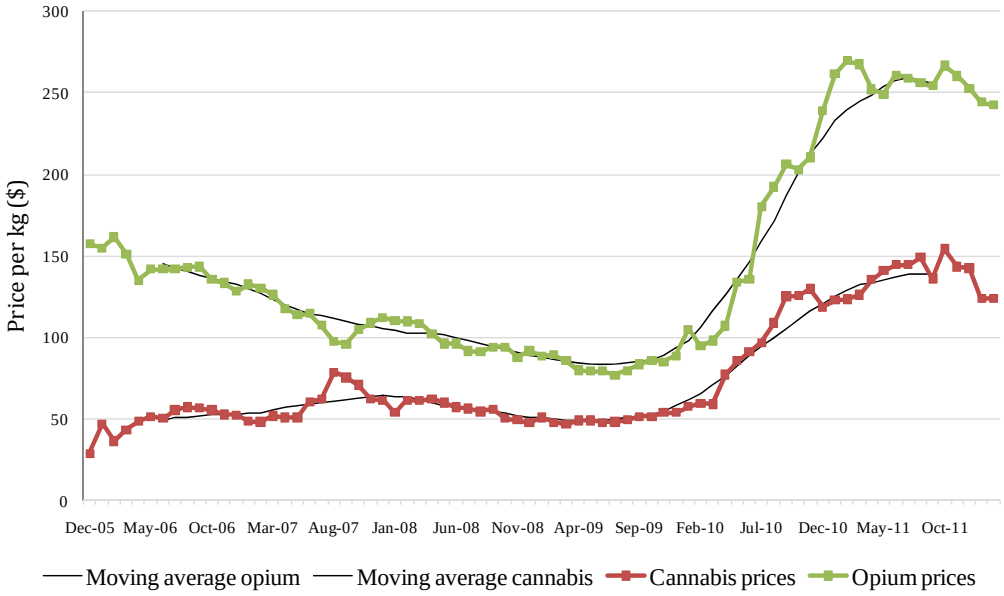
The *Opium Survey 2011* revealed that poppy-growing farmers are more likely to cultivate cannabis than non-poppy-growing farmers although the connection is less apparent. 6% of surveyed poppy-growing households cultivated cannabis in 2011 and the proportion among non-poppy growers was only half of that (3%). Why are these proportions so small?

The mere fact that the number of poppy-cultivating households is roughly 4-6 times greater than the number of cannabis-cultivating households (depending on which years are compared) explains to a large extent why, percentagewise, fewer poppy famers grow cannabis in a specific year than vice versa. Another argument explaining the relatively small percentage is that only a portion of cannabis farmers show up as such in a specific survey year because many of them grow cannabis only sporadically. Indeed, 86% of commercial cannabis-growing households have not actually cultivated it every year since 2006. It is thus very likely that, when monitored over several years, a much larger proportion of poppy growers (than the 6% mentioned above) would be seen to have grown cannabis on occasion and that there is a close link between poppy and cannabis, in both directions.

It seems that the link between cannabis and opium cultivation also exists at the trade level: information gathered during the 2011 surveyor debriefings indicates that a large proportion of cannabis traders also trade in opium, thus many households have the opportunity to sell both illicit crops relatively easily. Moreover, price developments in recent years substantiate the hypothesis of two closely integrated

markets: both price time series have shown a high correlation[10] since December 2005 when the collection of cannabis prices began (see figure 14).

Figure 14 Price data of cannabis and opium, 2005-2012



Source: Monthly price monitoring system, UNDOC.

Net income from cannabis cultivation is higher than from opium cultivation

Based on average prices at harvest time and the average 2011 resin yield, farmers achieved a gross cash income[11] of US$ 8,100/ha from cannabis resin in 2011, which is slightly less than the gross income from opium (US$ 10,700/ha). With an average under cannabis cultivation of 0.29 ha per household, the average gross income per household from cannabis in 2011 thus amounted to US$ 2,400. In 2010 the average gross income of cannabis growing households was US$ 3000/ha; the reduction comes from the reduced average area per household and smaller yield (-12%) in 2011.

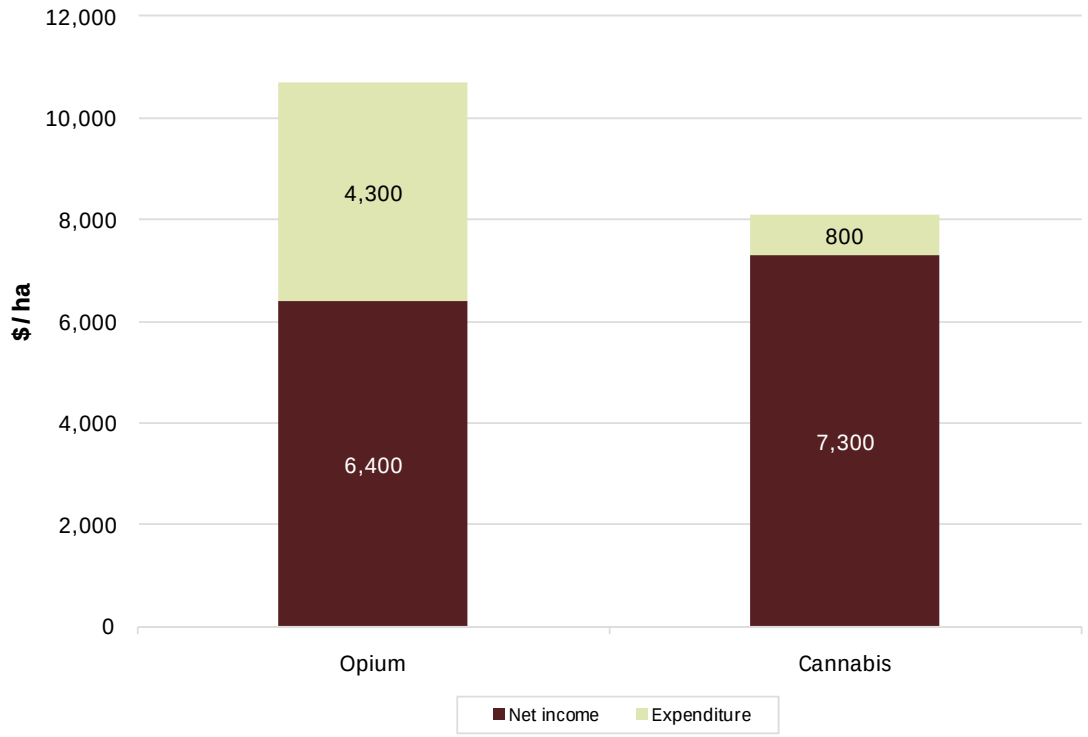
The expenditure per hectare on cannabis cultivation was estimated at US$ 800/ha or 10% of gross income. The relatively low proportion of expenditure compared with gross income is due to the massive increase in cannabis farm-gate prices between 2009 and 2011 and the relatively small increase in the prices of agricultural inputs.

The associated cost of cannabis cultivation was much lower than the cost of opium cultivation in 2011, which was estimated at US$ 4,300/ha or 40% of gross income from opium per hectare. The combination of its relatively high gross income per hectare and its relatively low cultivation cost makes cannabis a more profitable crop than opium poppy. Despite that, a much smaller number of households is involved in cannabis cultivation and the average area cultivated with cannabis per household is smaller than the average area per household cultivated with opium poppy. In addition, mixed cropping with cannabis cultivation is common in some regions but very rare in opium cultivation.

[10] Pearson Correlation 0.893 significant at 0.01 level.

[11] The gross income from cannabis resin does not take into account the potential value of cannabis by-products such as cannabis seeds or stalks.

Figure 15: Average annual per-hectare income from cannabis and opium (US$/ha), 2011



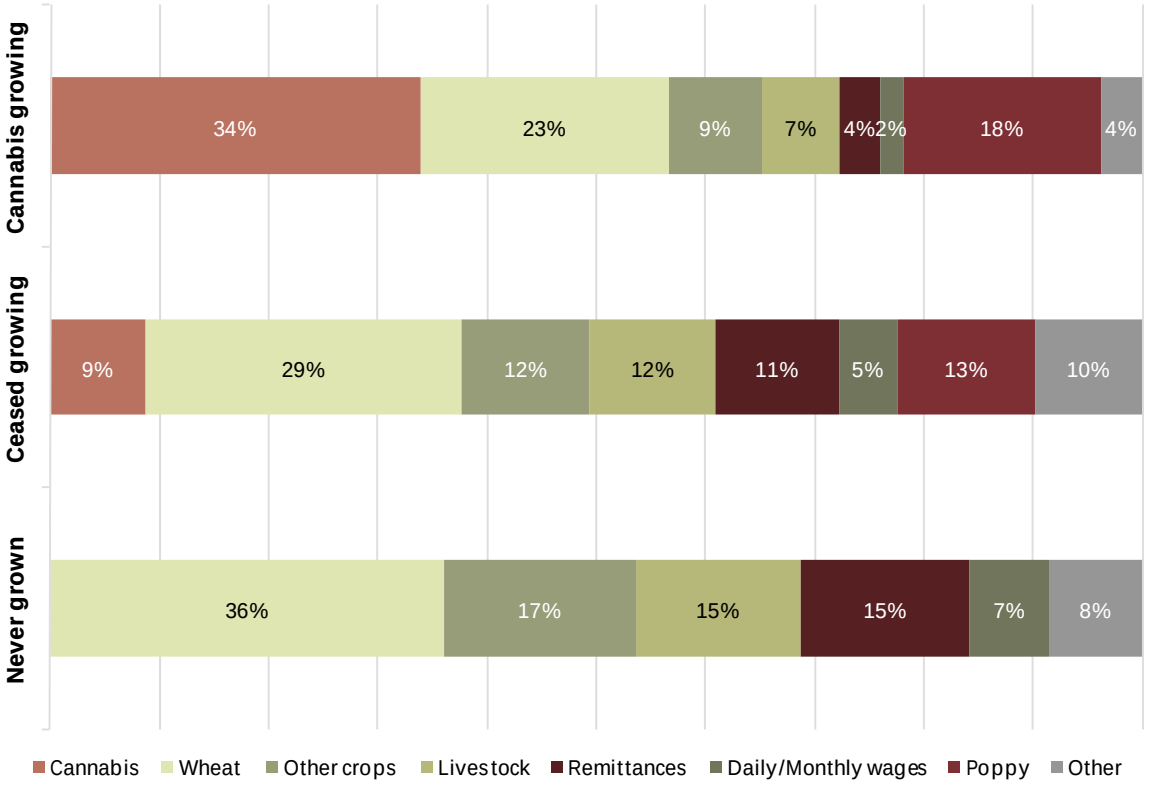
Nevertheless, cannabis seems to be an important cash crop. When comparing data on sources of income for 2010 (collected in 2011) for all three types of farmers — cannabis-cultivating farmers, farmers who ceased cultivating cannabis in 2011 or before, and farmers who had never grown cannabis — it can be seen that the average reported income of cannabis-cultivating farmers was higher than the income of farmers who ceased cultivation and farmers who had never cultivated cannabis.

Moreover, the main income sources for farmers who cultivated cannabis were cannabis (34%), wheat (23%) and poppy (18%). For farmers who ceased cannabis cultivation in 2011 or before the main sources were wheat (29%), opium poppy (13%), cannabis (9%) and other crops (12%). For farmers who had never grown cannabis the main income sources were wheat (36%), other crops (17%), livestock (15%) and remittances (15%).

With infrequent patterns of cannabis cultivation, cannabis farmers who had ceased cannabis cultivation did not necessarily do so permanently as it is perfectly possible that the majority of them will start to cultivate cannabis again in the future.

Poppy, then, does play an important role in the incomes of current and former cannabis farmers — another indication of the strong interrelationship between the cultivation of cannabis and poppy. Furthermore, remittances represent a much higher proportion of income in households that never cultivate cannabis (15%) compared to households that grow cannabis (4%). A similar pattern was observed in UNODC's opium surveys in which it was seen that households not growing poppy had a higher proportion of income from remittances, which may indicate that households without income from illicit cash crops can or need to rely more on remittances from abroad as they may not earn an equivalent income from other cash crops or income strategies.

Figure 16: Contributions to 2010 income, by type of farmer (data collected in 2011)



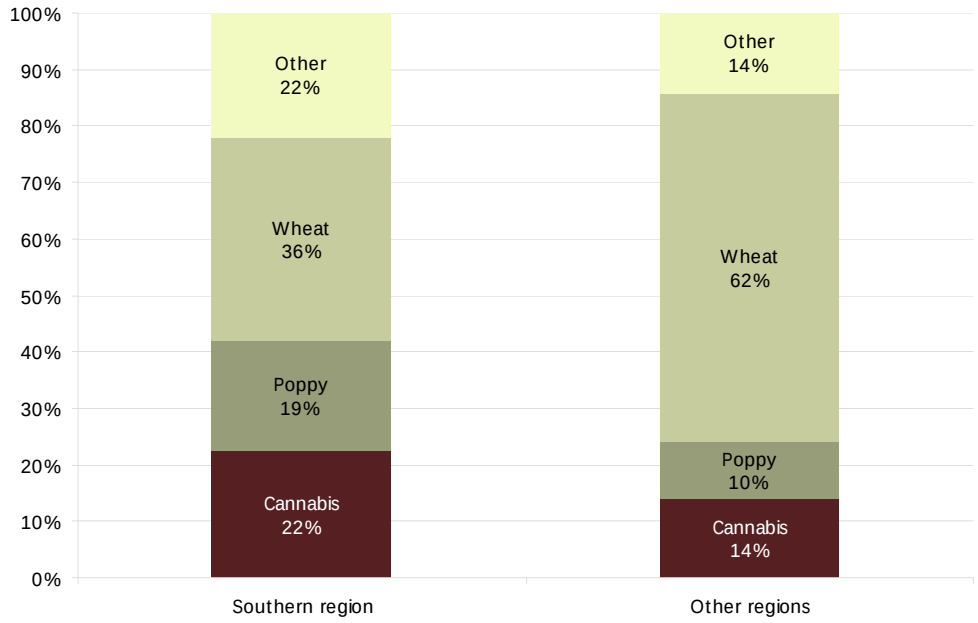
Cannabis and other cash crops

In 2011, farmers who cultivated cannabis also cultivated several other cash crops, such as cotton, poppy and vegetables, indicating that cannabis is not the only cash crop that cannabis farmers plant, but is typically one of several cash crops that make up a diversified cash crop strategy.

There is a clear difference between the Southern region and other regions in how farmers divide the area dedicated to cash crops. Overall in the Southern region, 22% of the area cultivated with cash crops was cultivated with cannabis and 19% with opium poppy in 2011, while other important cash crops were wheat (36%) and "other crops" (22%). This confirms the close link between cannabis and poppy cultivation in that region, as well as the fact that poppy was still the dominant illicit crop.

In other regions, wheat took up 62% of the cultivated area, followed by cannabis (14%), poppy (10%) and other crops (14%). Cannabis was only cultivated on 18% of the area utilized for cash crops, which indicates that cannabis-growing farmers in those regions have other cash crop options in addition to cannabis. There is currently no detailed information available on what kind of crops the "other crops" category included, but since it made up a large percentage of the available cultivated area more detailed research is required.

Figure 17: Distribution of cultivated area under main cash crops for cannabis farmers, 2011 (n = 417 farmers)



Possible explanations why cannabis is cultivated to a lesser extent than opium

Economic logic would suggest that if a farmer gets involved in illicit crop cultivation the crop of choice would be cannabis as it promises a higher net income. Furthermore, cannabis is less labour intensive as it needs less weeding and its harvest is easier than poppy lancing. However, UNODC's recent cannabis and opium surveys reveal that poppy is cultivated more frequently, by more households and over larger areas than cannabis.

There are several possible explanations why cannabis is a less attractive cash crop than poppy:

- Cannabis can be cultivated in summer only, which is when there is less land available for cultivation due to the decrease in the availability of water for irrigation. Conversely, during the main poppy and wheat season at the beginning of the year there is much more land available because of water released during snowmelt.
- Cannabis cultivation is particularly dependent on irrigation: there was a clear positive relationship between the availability of irrigation and cannabis cultivation at the village level.
- In subsistence agriculture, food crops and fodder are to a certain extent indispensable and may compete with cannabis for scarce land during summer.
- Cannabis has a comparatively long vegetation cycle. In other words, the field is "blocked" for an extended time when farmers could possibly grow several short-cycle crops such as vegetables. Furthermore, cultivating winter crops might not be possible on a former cannabis field because of its late harvest.

To fully understand the decision-making process of illicit crop farmers more detailed research on crop rotation, multi-period costs of cultivation and the agricultural conditions necessary for various crops is needed. Other important aspects are options for substitution: it seems that cannabis and opium are more complementary crops (farmers choose to cultivate both crops) than substitutes for each other (an either/or situation). But this only reflects the current situation since, with increasing pressure on poppy cultivation through eradication and other measures, the possibility of the commercial production of cannabis gradually playing a much bigger role in the illicit economy of Afghanistan is not beyond the realms of imagination.

Payment of tax on cannabis (Usher)

Usher is an informal tax of about 10% of the value of agricultural products paid by farmers to groups that control territories in rural Afghanistan. In 2011, few cannabis farmers (10%) reported paying usher on their cannabis production but there were strong regional differences between the Central and other regions, with more than 50% of cannabis farmers in the central region reporting the payment of usher, while few farmers in the Eastern, Northern, Southern and Western regions reported paying it. In the North-eastern region, no farmer reported paying usher in respect of their cannabis production.

Roughly two thirds of cannabis farmers reported paying usher in cash only (64%), while 33% reported paying usher in cash as well as in kind, and 3% reported paying it only in kind. Slightly more than a third of cannabis farmers (38%) reported paying usher to Mullah, 35% to Taliban, 26% to poor people and only 1% to Government officials.

Figure 18: Payment of usher reported by cannabis farmers in 2011, by region (n = 417 farmers)

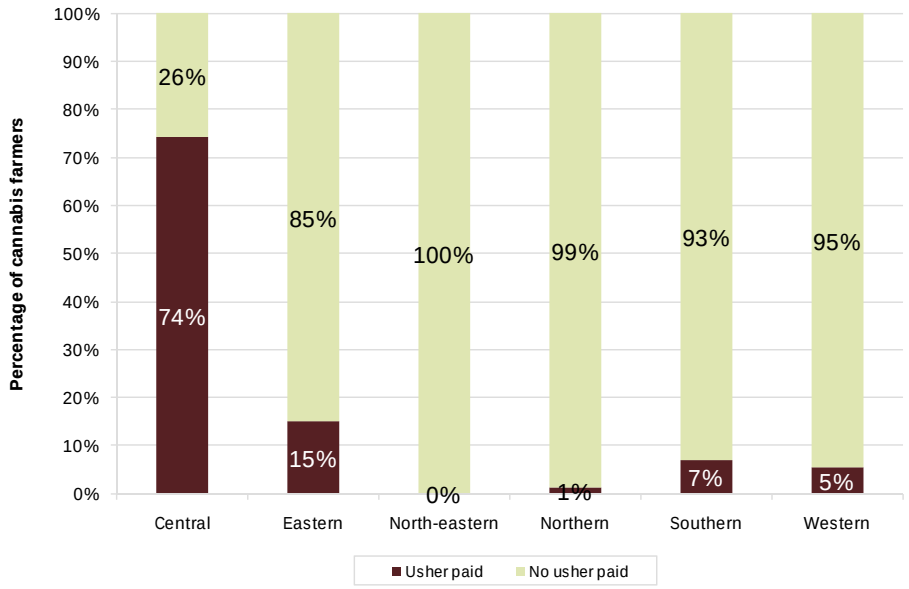


Figure 19: Type of usher payment made by cannabis farmers (n= 43 farmers)

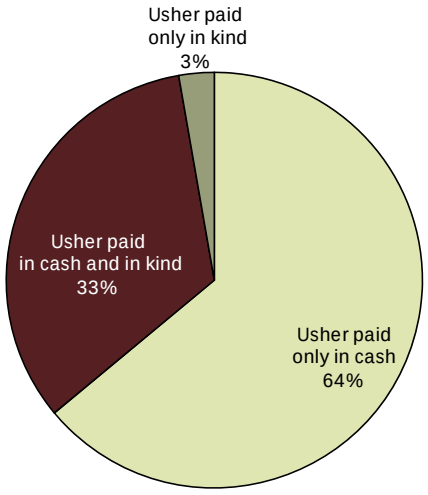


Figure 20: Recipients of usher payment, reported by cannabis farmers (n = 47 farmers)

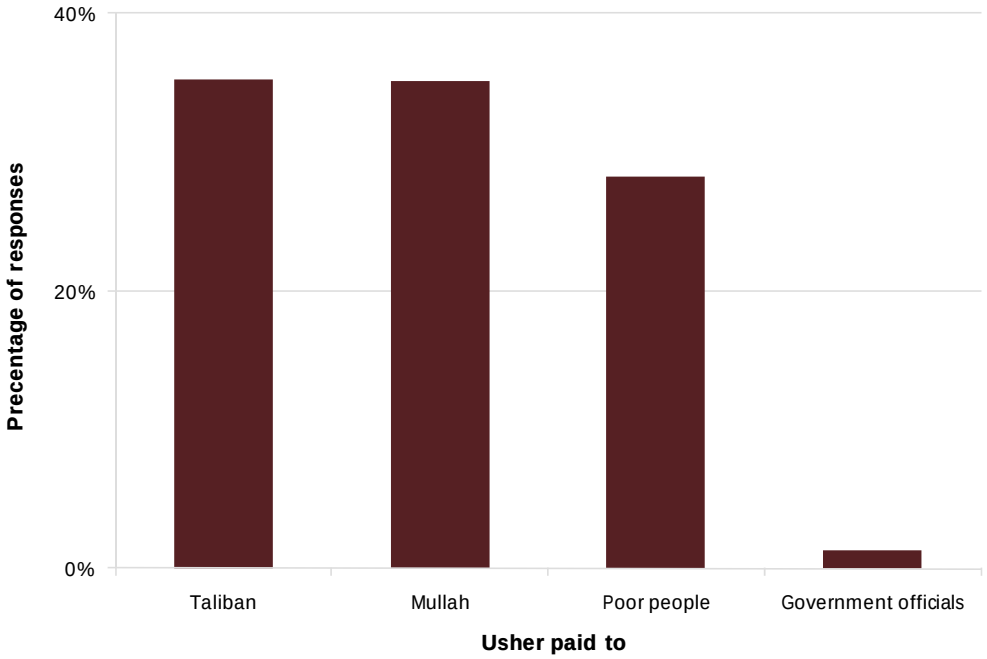


Photo 5: Heli-picture of cannabis fields in Paktya province, 2011

4 AFGHANISTAN CANNABIS AGRICULTURE

The cannabis plant[12]

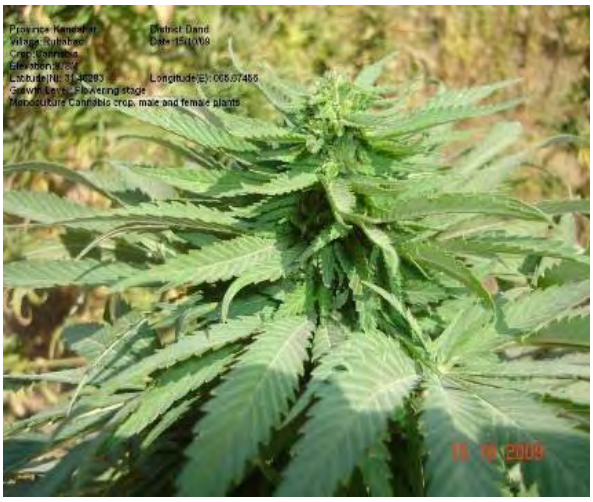
Cannabis (also known as marijuana or "marihuana") is a plant belonging to the Cannabaceae family. It is a dioecious plant, meaning that the male and female flowers develop on separate plants, although monoecious examples with both sexes on one plant are also found. The development of branches containing flowering organs varies greatly between male and female plants. Female flowers are tightly crowded between small leaves while male flowers hang in long, loose, multi-branched, clustered limbs up to 30 centimetres (12 inches) long and shed their pollen before dying several weeks prior to seed ripening on the female plant. Female plants tend to be shorter and have more branches than male pants and are leafy to the top with many leaves surrounding the flowers, while male plants have fewer leaves near the top, with few if any leaves along the extended flowering limbs, and can produce hundreds of seeds. Stems are erect, green and hollow and longitudinally grooved. It has been noted that cannabis plants can grow from 1 to 3 metres in height in different parts of Afghanistan.

Cannabis normally matures annually and timing is influenced by the age of the plant, changes in the photo-period (length of daylight) and other environmental conditions. Flowering usually starts when darkness exceeds 11 hours per day, and the flowering cycle lasts between 4 and 12 weeks, depending on environmental conditions.

Floral clusters should be harvested when resin secretion and associated terpenoid and cannabinoid biosynthesis are at their peak, which is just after the pistils have begun to turn brown but before the calyx stops growing. Floral clusters are responsible for the production of seeds, drugs and aromatic resins.

Yield varies across the different regions of the country. The product obtained from the dried cannabis plant through threshing and sieving is a powdery substance with varying proportions of resin and other plant matter, known locally as "garda". Further processing is required to turn garda into hashish (or "charas" as it is called in the local language), the consumable form of cannabis resin.

Photo 6: Morphological differences between male and female cannabis plants



Female cannabis plant in Dand district (Kandahar)

Cannabis varieties in Afghanistan

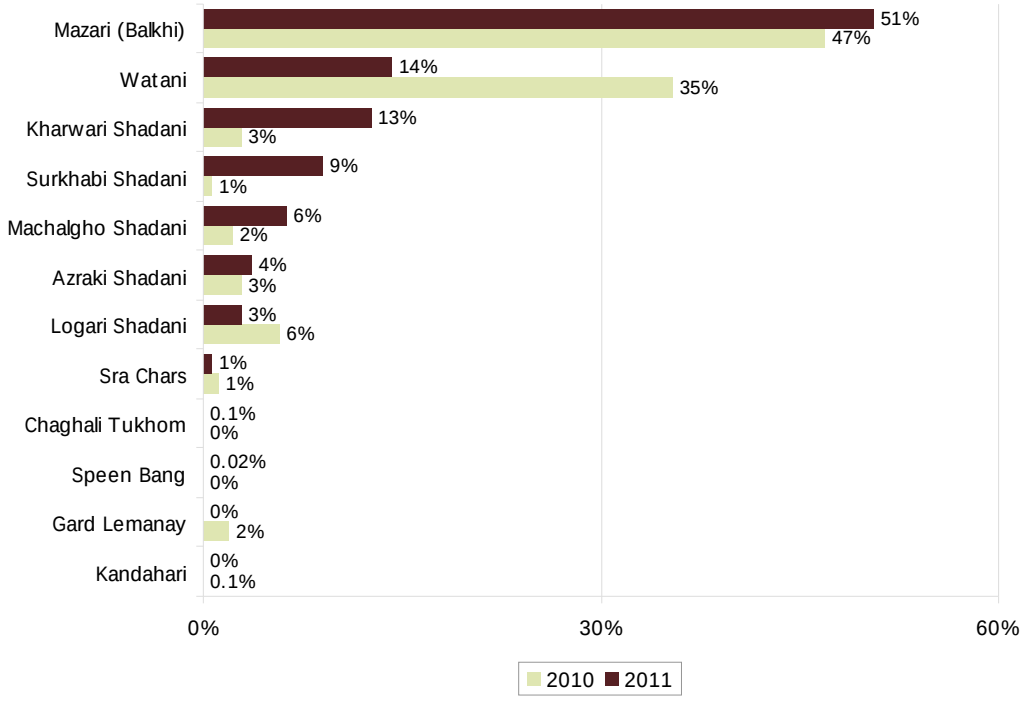
There has never been a comprehensive botanical study on cannabis varieties cultivated in Afghanistan. Information on varieties stems from farmers' responses, reflects their naming conventions and it is possible that the same varieties are known by different local names or that the same name is used for different varieties.

[12] Information from David T. Brown (1998): *Cannabis, the Genus Cannabis. Amsterdam*; Robert C. Clarke (1981): *Marijuana Botany*, Oakland; and from UNODC internal reports on cannabis in Afghanistan.

The most widely cultivated cannabis variety in Afghanistan reported in both 2010 and 2011 was Mazari (Balkhi), at 51% and 47%, respectively, followed by Watani (14% and 35%, respectively). Mazari (Balkhi) was the most commonly reported variety in the Southern, Western, Northern and North-eastern regions (52%, 72%, 83% and 74%, respectively). In the Eastern region, Azraki Shadani was the most commonly cultivated cannabis variety (36%), while Logari Shadani was the most cultivated variety in the Central region (33%).

The survey did not investigate THC content or other chemical properties of garda produced in Afghanistan, hence the potency and other properties of its different varieties are unknown.

Figure 21: Varieties of cannabis cultivated in 2010 and 2011, reported by cannabis farmers



Cannabis crop calendar

Typically, the planting season for cannabis in Afghanistan is between March and May. The stem elongation stage of cannabis is between July and August and the crop is in full bloom from September to October. In 2011, in most areas cannabis plants were fully matured and harvested from the field by the end of December. The resin was extracted between December 2011 and January 2012.

Results of the village survey show that the cannabis crop cultivation cycle differs slightly across the country due to variations in climatic conditions:

- Cultivation in the Southern region starts between March and June. Harvesting is done between September and December.
- Cultivation in the Central region starts between early April and May. Harvesting is done in October and November.
- Cultivation in the Northern region starts between April and May. Harvesting is done in November and December.
- Cultivation in the North-eastern region starts between March and April. Harvesting is done in October and November.
- Cultivation in the Western region starts between March and June. Harvesting is done in October and November.
- Cultivation in the Eastern region starts between May and June. Harvesting is done between October and December.

Seasonal price patterns of cannabis

Agricultural commodities most often exhibit seasonal price movements that are tied to the annual nature of the crop cycle. Crop prices are usually at their lowest near harvest due to supply pressure and are usually at their highest near the end of the crop year when supplies are less abundant.

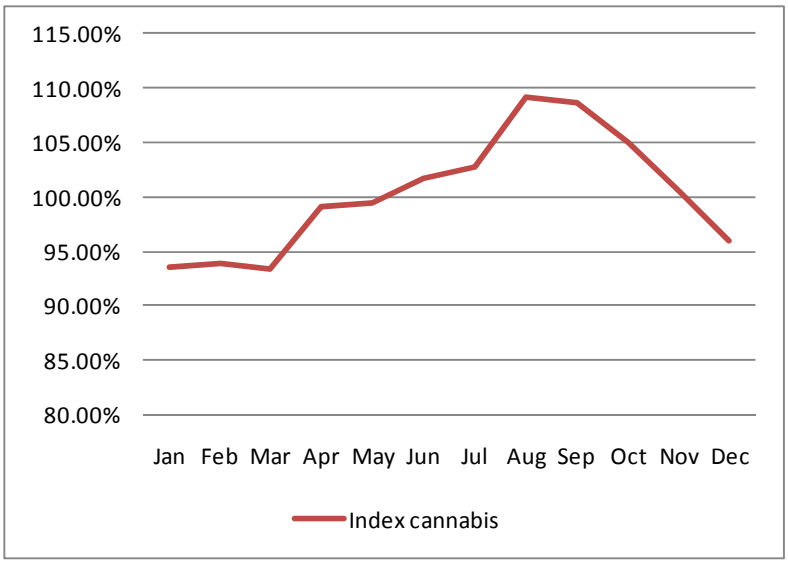
With the help of a seasonal price index representing average price movements over a number of years, a distribution of prices during the crop year can be calculated. The most commonly used technique for calculating a seasonal price index is the moving average, which isolates seasonal patterns from long-term trends.

By analysing the cannabis garda prices from the monthly price monitoring system (available since 2005) one can show that cannabis prices behave just like many other commodities: prices are lowest during and immediately after harvest (around December and January) and are highest at the end of the production cycle (around August or September).

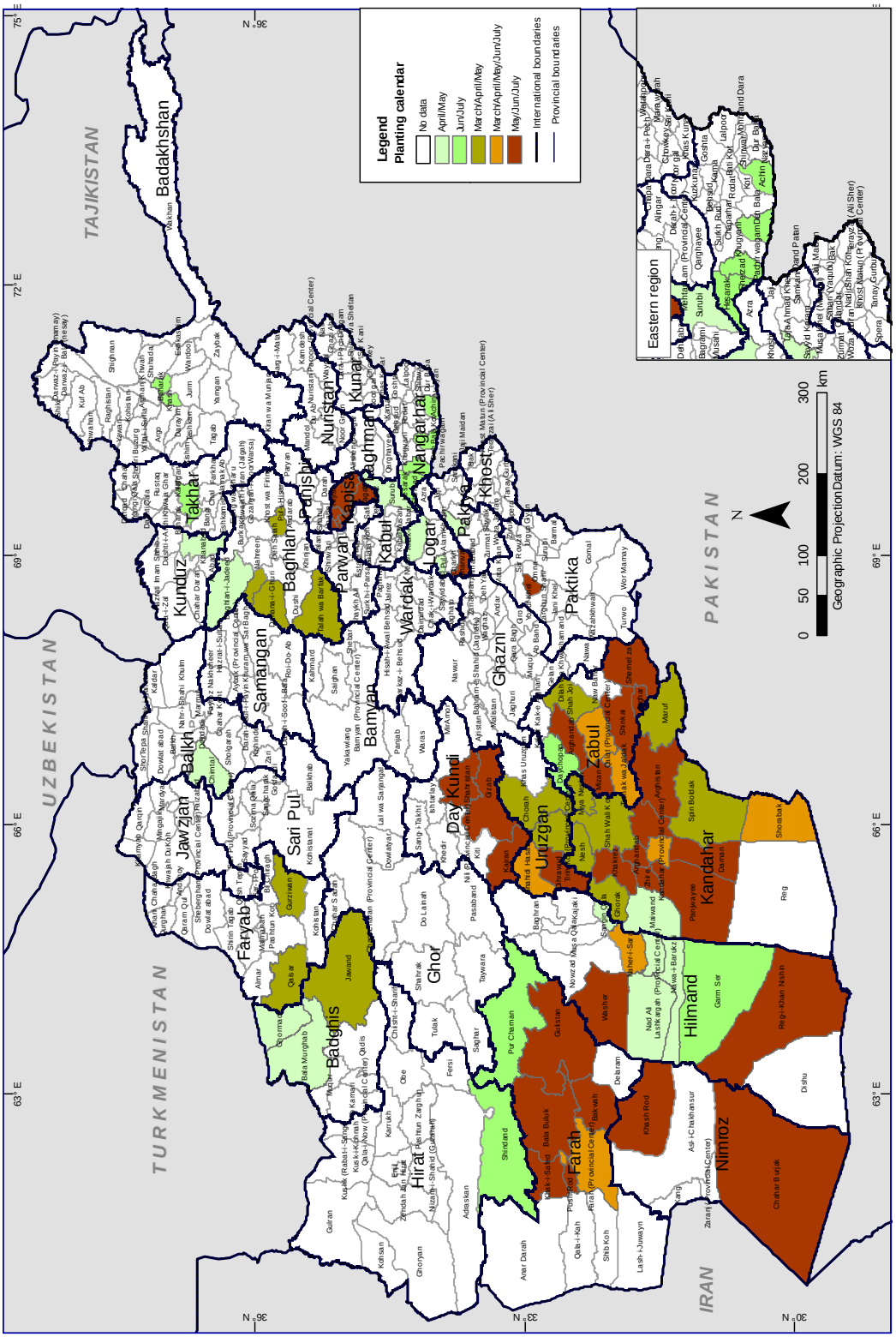
Figure 23 shows the seasonal price index for cannabis. In August, for example, the cannabis price is, on average, 109% of the moving annual average for August. For a more detailed description see the Methodology section of this survey.

This kind of analysis of long-term data collection can be used for several applications, such as for determining if current price developments follow an already established pattern or if a new or at least unexpected market dynamics is in place. However, at present, too little is known about the pricing and trading strategies of cannabis traders and farmers to fully exploit information of that nature.

Figure 22: Seasonal price index of cannabis

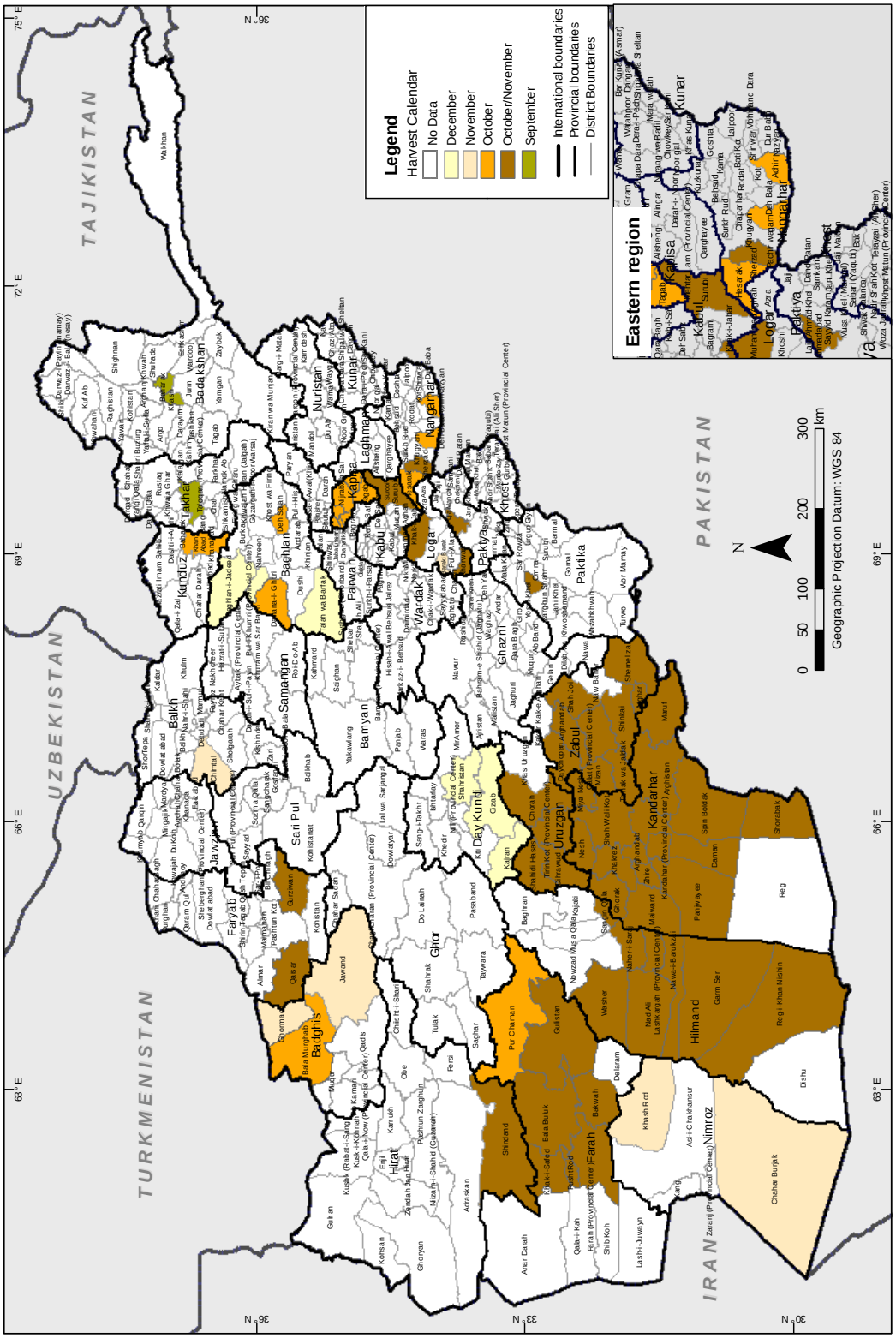


Afghanistan Calendar of cannabis planting, 2011



Source:MCN - UNODC Afghanistan Cannabis Survey, 2011
Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Afghanistan cannabis harvest calendar, 2011



Source: MCN - UNODC Afghanistan Cannabis Survey, 2011
Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

The production of cannabis resin

The production of cannabis resin in Afghanistan involves several steps.[13] First, cannabis plants need to be dried, then threshed and sieved to produce a powdery substance known locally as "garda". Through repeated sieving, farmers produce a graded quality that contains different concentrations of cannabis resin and are categorized as "first" garda, "second" garda and "third" garda. First garda is considered the best quality since it contains the highest proportion of resin and is thus more expensive than second and third garda. It is not yet known exactly how farmers and traders determine the garda grade other than by counting the number of sieving processes performed to extract the resin. The first, gentle shaking of the plant and sieving of plant material usually produces first garda quality, although this first garda powder may later be mixed with garda from subsequent sieving and still be known and traded as first garda.

Most cannabis farmers sell garda (resin) to traders in its powdery form, though some process it further into hashish, known locally as "charas". This transformation of garda into hashish is usually done by traders and is the final product used for trafficking and consumption. Information collected during the survey suggests that the amount of hashish produced from 1 kg of cannabis garda varies across regions, probably due to different hashish production methods. From current knowledge of different hashish production methods used in Afghanistan, it is reasonable to assume a 1:1 conversion rate of cannabis garda into hashish.

Photo 7 Cannabis garda processing in Logar province

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Separating cannabis leaves and flowers from the stalk (1)</td><td>Sieving of cannabis flowers through muslin cloth (2)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>First garda collection after sieving (3)</td><td>Separation of cannabis seeds (4)</td></tr>
</table>

[13] More information on cannabis resin yield and hashish production can be found in UNODC/MCN: *Afghanistan Cannabis Survey 2009*, April 2010.

Photo 8 Pictures of cannabis fields at flowering stage

Cannabis at flowering stage cultivated as mono crop, Sherzad district of Nangarhar province.

Cannabis at flowering stage cultivated on bund in wheat field in Baraki Barak district of Logar province.

Cannabis at flowering stage cultivated as mixed crop with maize in Sherzad district of Nangarhar province.

Cannabis at flowering stage cultivated as mono crop in Shindand district of Hirat province.

5 METHODOLOGY

The survey was made up of three main components:

- A questionnaire survey in a sample of villages, randomly selected under an area frame sampling approach, with interviews of village headmen and three farmers per village.
- A remote sensing survey using a sample of satellite images, randomly selected under an area frame sampling approach.
- A yield observation survey, which investigates cannabis yield per field, harvest and processing of cannabis.

Information from different survey instruments was complemented by information from the monthly price monitoring system, which also covers cannabis resin, and from the Annual Opium Surveys where appropriate.

Survey components

Village survey

The sampling follows the guidelines of an area frame sampling design. An area frame sampling design is a widely used methodology in agricultural statistics. For the aims of this survey the following steps were carried out.

Construction of the sampling frame: the purpose of stratification in any survey is to reduce the variance of the variables under study in each stratum. The village frame is a list of villages compiled by The Central Statistical Office in Afghanistan and the Afghanistan Information Management System (AIMS). It contains the village name, district name, province name, location, number of households, and average household size. It has 41,419 villages in total.

By consultations with survey coordinators in Afghanistan, it was concluded that several provinces in Afghanistan have little or almost null cannabis cultivation. In order to optimize resources, it was decided to exclude those provinces from the sampling frame. Hence, only 23 out of the 34 provinces in Afghanistan were targeted as potential areas with cannabis cultivation (cannabis risk area). Considering only the cannabis risk area, the sampling frame consists of 28,110 villages.

Sample size: more than one item or characteristic is usually measured in surveys and often the number is large. If a desired degree of precision is prescribed for each item, the sample size calculations lead to a series of conflicting values for the sample size *n* (see Cochran, Wiley 1977 for formulae).There is a budget constraint due to field and operations costs, limiting the village survey to cover up to 1,608 villages. The chosen approach assigned a number of villages to each province that was proportional to the square root of the size of the province (measured in number of villages). To take large differences in size into account and to maintain a similar precision for all villages, a minimum number of sampled villages was introduced.

During the village survey 133 surveyors visited 1,509 responsive villages out of a total of 1,608 sampled villages spread over 23 provinces and 259 districts. Altogether, 133 surveyors interviewed 4,527 farmers in the village survey.

Data collection and data entry

The village survey was carried out by experienced surveyors of UNODC/MCN Afghanistan under the close supervision of UNODC/MCN Survey Coordinators, who have also been involved in the opium poppy survey for many years. The methodology of the Cannabis Survey 2011 covered various tools, such as the village survey through a questionnaire of different types of farmers: “cannabis growing”, “ceased cannabis growing” and “never grown cannabis”. The village survey also included village headmen to understand the extent of cannabis crop cultivation and socio-economic factors behind cultivation. In addition to the village survey, other important methods such as ground truth collection for the imagery interpretation, area estimation of cannabis fields as well as the growth calendar of the crop and yield survey were part of the survey. In fact, the survey methodology was based on a sampling approach and was combined with the use of satellite imagery and extensive field visits.

The data was collected by trained surveyors through the questionnaire prepared for interviewing farmers cultivating cannabis, farmers who had ceased cultivating cannabis, farmers who had never grown cannabis and the headman of the village in order to get his perception regarding cannabis cultivation. The questionnaire also covered socio-economic aspects of farmers, reasons, the receipt of agricultural assistance and access to facilities such as school, phone, medical centre, road and transportation, electricity, drinkable water, off-farm employment, market for agricultural products, credit, irrigation water and training on vocational skills. All the questionnaires were reviewed by the regional Survey Coordinators and sent to UNODC or MCN central survey section. The data were entered by the data clerks based in the Ministry of Counter Narcotics (MCN) under the supervision of the Data Management Officer of UNODC, survey section.

Remote sensing survey

Fourteen provinces of the cannabis risk area (see table 8) were associated with large-scale cannabis cultivation suitable for a remote sensing survey with satellite imagery. For 3 out of those 14 provinces a targeting approach was used, i.e. the area covered by the imagery was chosen based on field information on cannabis cultivation, because the area under cultivation was expected to be too low and/or too concentrated in just a view locations for a sampling approach to be successful with the available means for acquiring satellite imagery. In the remaining 11 provinces cannabis cultivation was too widespread to use the target approach, therefore a sampling approach with randomly sampled images was used.

The image size was set to 8 km by 8 km. With that size a total of 136 images was available for sampling (9 missed and could not be evaluated) and 28 images for targeted provinces, making a total of 155 very high-resolution satellite images.

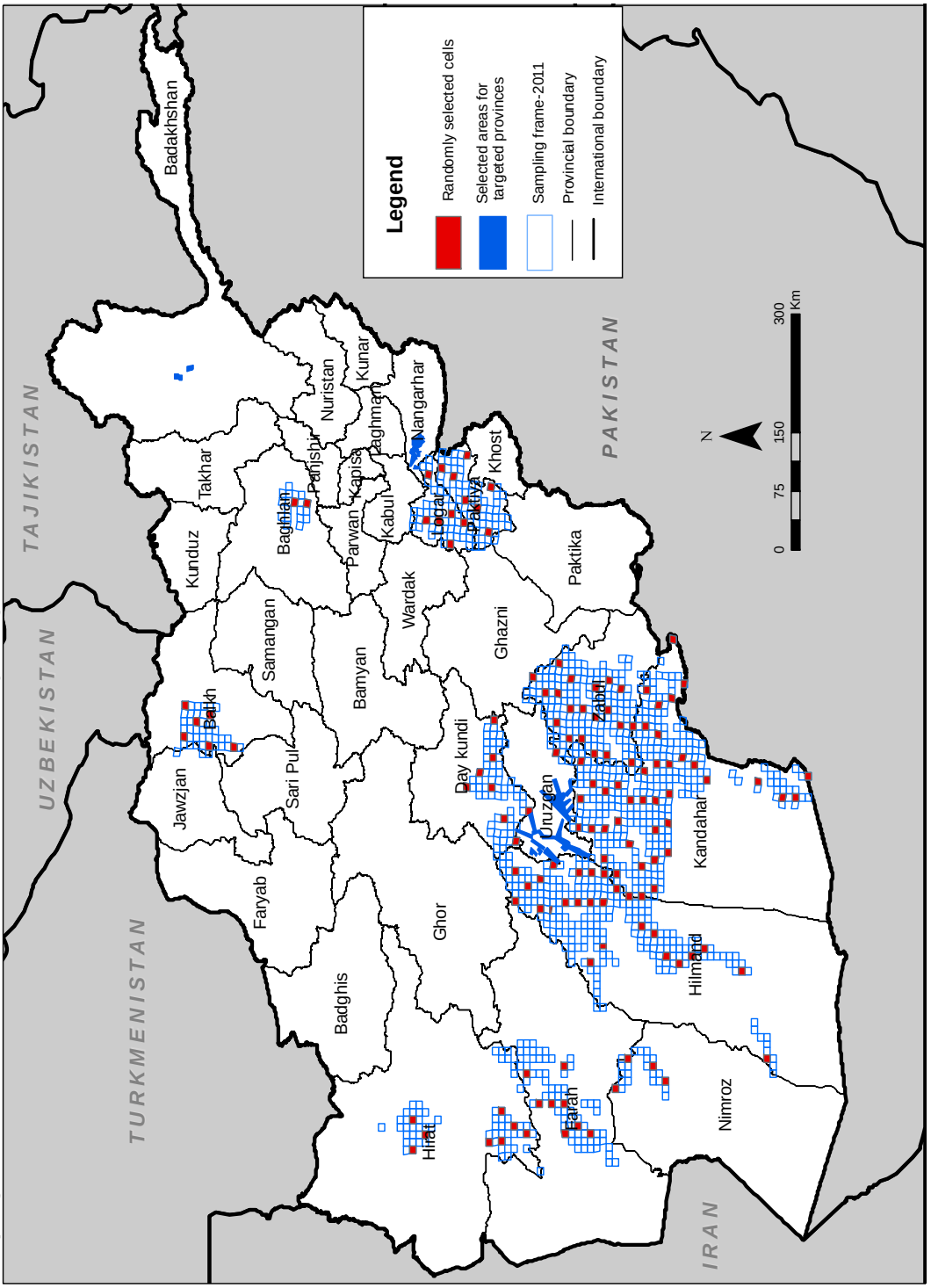
The sampling method was a systematic sampling. This method is an equal-probability method, in which every k^{th} element in the frame of size N is selected, where k is the sampling interval given by $k = N/n$ with n the sample size. To ensure equal inclusion probabilities for all sampling units a random cell is chosen, from which a two-dimensional step pattern is started. This form of sampling ensures a geographically equally distributed sample over the whole frame, which is a particular advantage if little is known about the distribution of the area of interest. The sample was not drawn on the basis of provinces, but on a national scale, and is therefore not suitable for making estimates of sufficient precision at the province level.

In the cannabis surveys it has become clear that the active agricultural area on the imagery taken for the cannabis estimates is much smaller than the potential agricultural land ("ag mask") on which the sampling frame is based. Active agricultural land is by definition smaller than the potential agricultural land. However, the differences were larger than those observed in the poppy cultivation season, because cannabis is grown later in the year, when less water is available. UNODC, together with academic partners, is undertaking research to better understand the year-to-year changes of active agricultural land and differences between winter and summer agricultural seasons in Afghanistan.

Table 8: Sample and target provinces, 2011

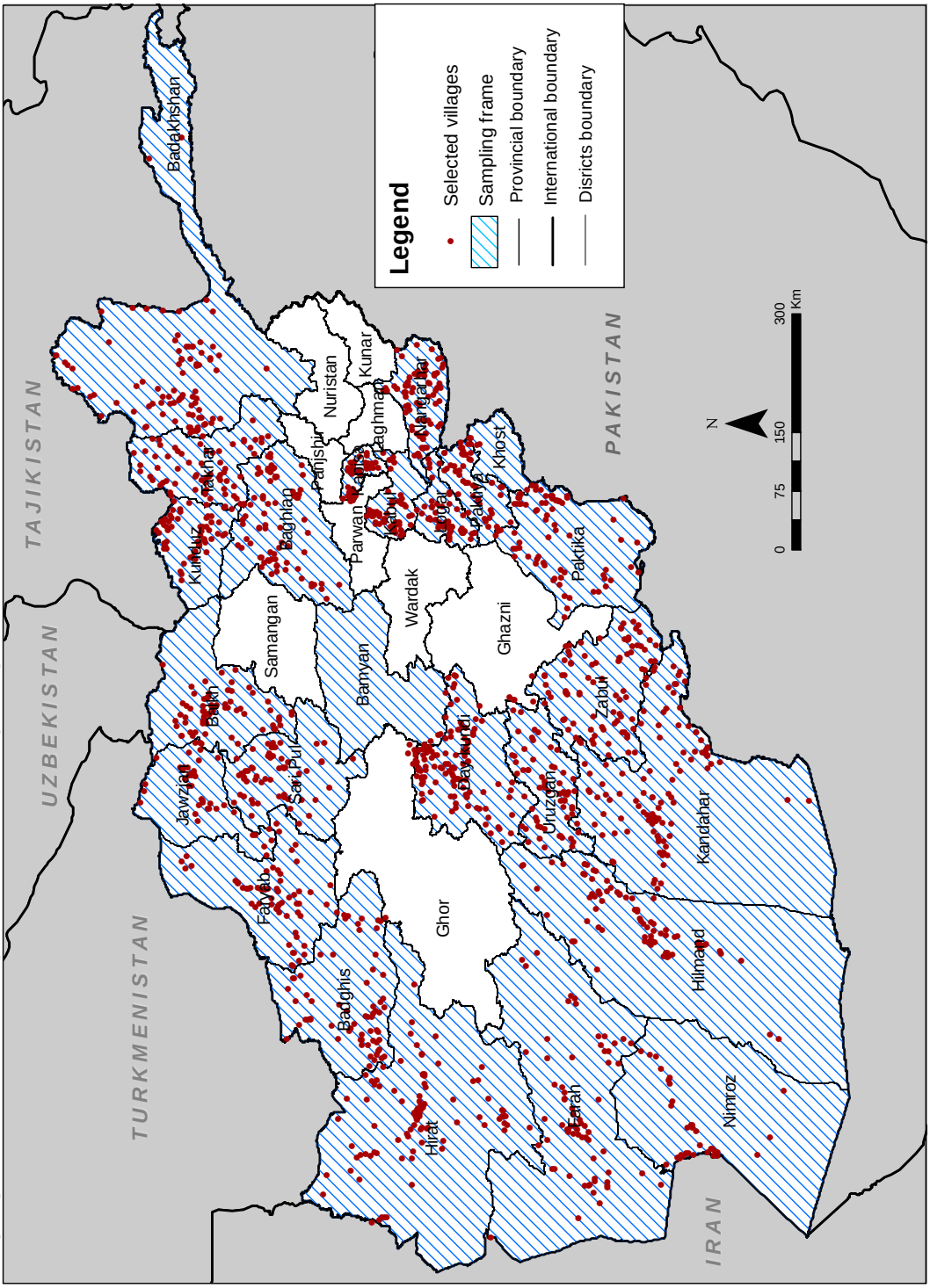
Sample	Baghlan, Balkh, Day Kundi, Farah, Hilmand, Hirat, Kandahar, Logar, Nimroz, Paktya, Zabul	Total: 11
Target	Badakhshan, Nangarhar, Uruzgan	Total: 3
Village Survey	Badghis, Faryab, Jawzjan, Kabul, Kapisa, Kunduz, Paktika, Takhar, Sari Pul	Total: 9

Sampling frame & selected cells for cannabis satellite survey in Afghanistan, 2011



Source: MCN - UNODC Afghanistan Cannabis survey 2011
Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Sampling frame & selected villages for cannabis survey in Afghanistan, 2011



Source: MCN - UNODC Afghanistan Cannabis Survey 2011
Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Ground truth collection

Ground truth refers to information that is collected "on location". This is especially important for relating image data to actual cannabis fields on the ground. The collection of ground-truth data enables calibration and aids in the interpretation and analysis of areas of interest on the satellite images.

Ground truth information (GPS points) was collected in Badakhshan, Nangarhar and Uruzgan provinces. The collection of ground truth in most of the Southern region was difficult for the surveyors and survey coordinators.

Cannabis Yield Observation Survey

Cannabis yield was estimated based on the results of the cannabis yield observation survey. This survey was conducted in January 2011, when farmers actually processed the harvested and dried cannabis plants to obtain cannabis resin. In January 2011, surveyors went to selected farmers and witnessed the cannabis resin (garda) production from those fields. The garda yield of different qualities was measured.

In the survey the following fields were included:

Table 9: Distribution of fields, by type in the yield observation study, 2011

Mono Crop	Mixed cultivation	Cultivation on boundaries	Total number of fields
60	33	14	107

Farmers were interviewed on the yield obtained from a previously identified field, including all yield qualities, as well as on the cannabis extraction method used, cannabis seed yield, timing and duration of harvesting, drying, and garda extraction, people involved and hashish production.

Capacity building

- Training of Survey Coordinators (SC) of UNODC and MCN for village survey and yield survey
- Training for surveyors for collection of GPS points for target provinces
- Training for data clerks on data cleaning procedure by the UNODC database management officer.

Estimation methods

Area estimation from remote sensing in sampled provinces

The sample was designed for yielding an estimate for all provinces under consideration, meaning that it was designed for directly providing an estimate of the total area under cultivation in all 14 sampled provinces (see table 7). The total area was estimated by employing a ratio estimate on the share of cannabis cultivation within the available agricultural area. Hence, the ratio A_c/A_a is estimated, where A_c denotes the area of cannabis cultivation and A_a the agricultural area. The ratio estimator employed uses the ratio of the sum of the values of A_p for the sampled cells, divided by the sum of the values of A_a for the sampled cells:
Let $\hat{r}$ be the estimate of the ratio $r = A_{ctot} / A_{atot}$ with

$$\hat{r}_{ratio} = \frac{\sum_{sample} A_c}{\sum_{sample} A_a}.$$

By applying the estimated ratio to the agricultural area an estimate of total area under cannabis cultivation is yielded.

Area estimation from the village survey

According to field information and to results from previous surveys, seven provinces in the cannabis risk area seemed to have only very scattered cannabis cultivation or cultivation at such a low level that is was decided to not cover them with satellite images. The decision was based on finding an optimal allocation

of resources. However, the village survey revealed that in five out of those seven provinces cannabis cultivation existed at a measurable level.

Headmen are asked for the total area of cultivated cannabis in the village. This estimate of the headmen can be used for extrapolating to a provincial estimate by calculating an average area per village and multiplying this estimate with the number of villages in the province. Headmen estimates are not as reliable as satellite surveys and are particularly likely to overestimate the area under cultivation. Therefore we calculated all provincial estimates and compared them to provincial estimates coming from the satellite survey (the sampling was not designed for producing provincial estimates, but the estimates are still considered to be more reliable and accurate than the headmen estimates). Headmen estimates and satellite survey estimates had a strong linear relationship (R^2=0.77); meaning that it seemed to be a safe assumption that the area estimates from the village survey could be modelled as a linear function of the satellite survey estimates. By using the best fit straight line y=ax+b through the points where both a village survey and a remote sensing survey estimate was available, the corrected estimates of the village survey results for the remaining provinces were calculated.

The estimate of the total area under cultivation is the sum of the estimates from the remote sensing of sampled provinces, the targeted provinces and the provinces covered by the village survey only.

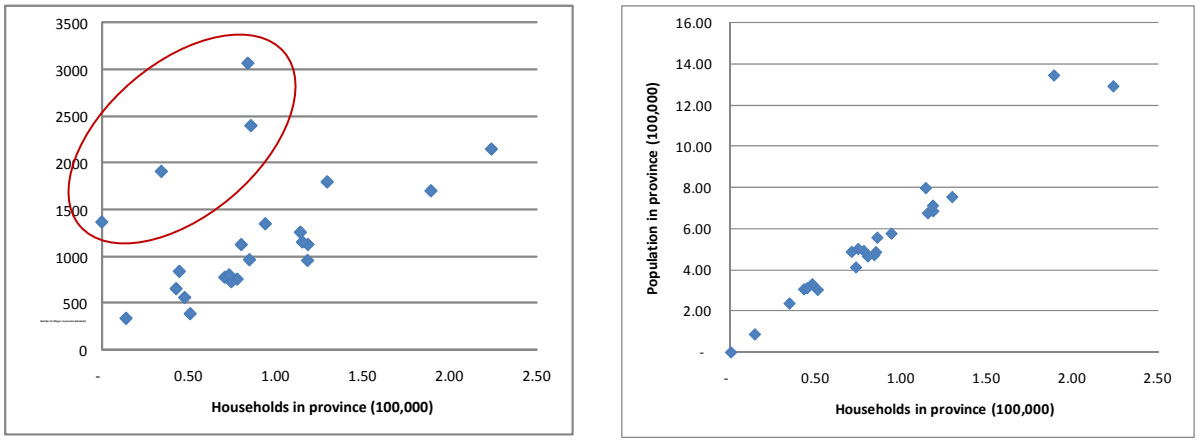
Inconsistencies with the village frame

The village frame is a list compiled by The Central Statistical Office in Afghanistan and AIMS. It contains the village name, district name, province name, location, number of households, and average household size of 41,419 villages.

The following two figures show scatter plots of the numbers of households (x-axes) together with the numbers of villages (left) and with the population size (right).

As one can see, the total population is highly correlated with total numbers of households (all dots align along one line), whereas the number of villages compared to the numbers of households in the province has four remarkable outliers in the Day Kundi, Kandahar, Nangarhar and Zabul provinces (all within the red circle). When compared to household numbers a relatively larger number of villages can come from a significantly smaller size of village, however, double counting of villages or other problems with the database cannot be excluded. Deeper analyses of these issues are out of the scope of this survey; but the discrepancies between the number of villages and the number of households in some province should be kept in mind when interpreting the results. Too large a number (relatively) of villages can lead to an overestimate of indicators of interest (for example, the area under cultivation).

Figure 23 Scatter plots of household data, village data and population data of the village frame



Estimation of yield and production

The basis of the yield estimates is the yield observation study (see respective section for details). Information on these fields was used for calculating a yield per hectare separately for mono-crop fields in the Northern and North-Eastern region and for the South-East-Central-West region. This distinction stems from different garda production practices, which result in different yields.

Cannabis yield per hectare in mixed-crop fields depends on several factors, such as plant density or the type of the other crop. In some cases the fields had one row of cannabis and one row of mixed crop (for example, when combined with potatoes), in other cases plants were mixed randomly (for example, when combined with maize). It was therefore not possible to determine a clear pattern for the different cultivation types.

For cultivation on bunds in fields the concept of per-hectare yield needs to be replaced by a "per-metre yield", which could be estimated on the basis of the yield observation factor. The unknown variables here are thus the length of bunds cultivated, which depends on field size, and the number of edges under cultivation.

To provide a production estimate for those types of fields the most straightforward method was, therefore, to estimate a yield per field for fields with cultivation on bunds and mixed-crop fields. This yield per field was then applied to an estimate of the total number of mixed-crop fields and of the number of fields with cultivation on bunds. To make sure that the resulting production results are realistic the average field size was compared from three different sources: the data from the yield observation study for mixed and mono-crop fields, data from fields with cultivation on bunds and from headmen interviews on cannabis cultivation. All three sources had average field sizes of between 0.04 and 0.12 ha, which was encouraging for providing a yield per field based estimate.

Cannabis-cultivating households

The number of cannabis-cultivating households was estimated from information provided by headmen in the sample villages on the number of households involved in cannabis cultivation compared to the total number of households in the village. This number included any kind of cannabis cultivation, i.e. it may have included households with only small-scale cannabis cultivation, such as in kitchen gardens.

The number of cannabis-cultivating households was estimated by calculating the proportion of cannabis-growing households for each surveyed village, and calculating the weighted average proportion of cannabis growing households per village for each province of the sampling frame (the cannabis risk area). The weights represent the probability of villages being selected and included in the sample. The provincial averages were multiplied with the total number of households in that province to obtain the total number of cannabis-growing households per province. The sum of all provinces is the national estimate.

Farm-gate value of cannabis production

Similar to the methodology used in the *Annual Opium Survey*, the farm-gate value of cannabis was calculated based on the prices observed in the monthly price monitoring in the month of harvesting/garda production, when farmers were actually able to start selling their products, which was January 2011. As monthly price monitoring only collects prices of first garda, second and third garda prices were calculated from the average price difference between first and second and first and third garda reported by headmen in the village survey. The first garda price of the yield regions used in this report was calculated as the simple average of the provincial prices reported in the price monitoring report.

The upper and lower bound of the farm-gate value was calculated by using the upper and lower bounds of the area estimates for the respective regions and on an upper bound for the yield per field for mixed cropped fields and cultivation on bunds.

Income from cannabis

The potential gross income per hectare from cannabis resin was calculated based on regional prices and regional yields, using the regional divisions described above. The gross income does not take into account expenditures, and is the potential cash income individual farmers would get if they sold the total resin produced in January 2011. The weighted average was calculated using the proportions of regional cannabis cultivation from the remote sensing survey as weights.