



Economic and Social Council

Distr.: General
2 January 2013

Original: English

Commission on Narcotic Drugs

Fifty-sixth session

Vienna, 11-15 March 2013

Item 4 of the provisional agenda*

Implementation of the international drug control treaties

The use of cannabis seeds for illicit cultivation

Report of the Secretariat

Summary

The production and consumption of cannabis is a global phenomenon. Reports on cultivation, seizures of cannabis plants and the sources of cannabis products illustrate that cannabis is not only consumed in virtually all countries, but is produced in most of them too. In its resolution 52/5, the Commission on Narcotic Drugs, noting that a number of Member States had reported an increase in the availability of the cannabis plant and emphasizing the primary importance of international cooperation in combating trafficking in cannabis, paying attention to trafficking in cannabis seeds derived from and for illicitly cultivated cannabis plants, requested the United Nations Office on Drugs and Crime to conduct a global survey on cannabis seeds, starting with a market survey. The present report presents the preliminary results of the market study undertaken by the Office, which show the different roles that cannabis seeds play in the cultivation and production of cannabis.

In traditional outdoor farming of cannabis, cannabis plants are grown by sowing locally produced seeds. Seeds are either self-produced by the farmer, shared among farmers or obtained at informal or open local markets.

In modern cannabis production, which is characterized by the use of technologically advanced methods and a high concentration indoors, the vast majority of plants are produced by cloning. A clone is a live cutting from an adult plant and produces identical plants.

Commercially available cannabis seeds do, however, play an important role in diversifying plant varieties according to taste and potency and in starting small-scale

* E/CN.7/2013/1.



cannabis cultivation. A global market in high-quality, commercially produced and marketed cannabis seeds exists and it specifically targets small-scale and sole-use growers (“home growers”). It advertises potent cannabis products with great variation in taste, strength and effect. Those seeds can be purchased in specialized shops (“grow shops”) and through the Internet, and are shipped worldwide in small quantities, packaged discreetly so as to avoid seizures by customs or police. The global market also facilitates the spread of high-quality, highly potent and high-yielding cannabis strains.

Geographically, most of the commercial seed producers are located in North America and Europe; resellers of seeds are more widespread and market their products in a variety of countries, as is shown by the availability of advertising material in several languages. This also indicates that the use of commercialized seeds for illicit cannabis production is a worldwide phenomenon, but one that is more predominant in developed countries.

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I. Introduction

1. The production and consumption of cannabis is a global phenomenon. Reports on cultivation, seizures of cannabis plants and the sources of cannabis products illustrate that cannabis is not only consumed in virtually all countries, but is produced in most of them too.¹

2. The cannabis plant can be easily cultivated both indoors and outdoors, and the relatively simple production of cannabis herb has led to its being produced and traded almost everywhere in the world, often in local markets. Much of the demand for cannabis products is covered by domestic production, but many countries continue to report that significant proportions come from intraregional trafficking.² The spread of production sites that serve nearby consumers is thus an important global trend.

3. A number of Member States have reported an increase in the availability of cannabis plants, notably plants cultivated indoors, and an overall increase in the average tetrahydrocannabinol (THC) content of some varieties of cannabis plant.³

4. In its resolution 52/5, the Commission on Narcotic Drugs emphasized the primary importance of international cooperation in combating trafficking in and abuse of cannabis, paying attention to trafficking in cannabis seeds derived from illicitly cultivated cannabis plants, and recognized that cannabis seeds were tradable goods not controlled by the international drug control conventions. Cannabis seeds do not contain THC and they can be used for legal purposes such as for animal feed or dietary supplements or for producing oil.

5. In accordance with the request to the International Narcotics Control Board to gather regulatory information on cannabis seeds from Member States, the Board undertook a study in 2010 and reported the results in its 2010 annual report.⁴ The President of the Board also presented the findings to the Commission on Narcotic Drugs in March 2010. The box below summarizes the main findings of the study.

Results of a survey on regulatory information on cannabis seeds conducted by the International Narcotics Control Board

(a) Out of 211 Governments contacted by the International Narcotics Control Board, 104 (49 per cent) responded to the request for information. The answers showed that a wide range of regulatory approaches were applied to control trade in cannabis seeds in their respective countries;

(b) A majority of the responding Governments (59 per cent) reported the regulation of cannabis seed production through national laws or administrative regulations. Different strategies were taken. One strategy was to include cannabis seeds in the legal definition of cannabis for narcotic purposes that regulated the

¹ See, for example, *World Drug Report 2009* (United Nations publication, Sales No. E.09.XI.12); *World Drug Report 2010* (United Nations publication, Sales No. E.10.XI.13); and *World Drug Report 2011* (United Nations publication, Sales No. E.11.XI.10).

² *World Drug Report 2010*.

³ *Ibid.*, *World Drug Report 2011*; and Commission on Narcotic Drugs resolution 52/5.

⁴ *Report of the International Narcotics Control Board for 2010* (United Nations publication, Sales No. E.11.XI.1).

production of cannabis seeds as a controlled narcotic drug. Other approaches included placing only viable cannabis seeds under national drug control; permitting the production of seeds whose tetrahydrocannabinol content was below an established threshold; or permitting the import of cannabis seeds only with special authorization;

(c) With respect to international trade, about half of the responding Governments (53 per cent) indicated having provisions to control the import of cannabis seeds and about half (47 per cent) reported having provisions to control the export of cannabis seeds. About half of the responding Governments (51 per cent) regulated the domestic sale, purchase, advertisement or possession of cannabis seeds. The vast majority of the responding Governments (87 per cent) reported having no specific regulations on the sale of cannabis seeds through the Internet. Many, however, emphasized that the sale of cannabis seeds through the Internet was covered by general provisions on the sale of cannabis seeds, which were applicable irrespective of the mode of sale;

(d) One third of the responding Governments (33 per cent) reported having noted suspicious transactions involving cannabis seeds to be used for illicit purposes or having seized cannabis seeds, mostly in small quantities.

Source: Report of the International Narcotics Control Board for 2010 (United Nations publication, Sales No. E.11.XI.1).

6. The remainder of this report describes the preliminary results of a global study on cannabis seeds, which the United Nations Office on Drugs and Crime (UNODC) started in 2011 when extrabudgetary funds became available.

II. Background information on the cannabis plant*

7. The cannabis plant belongs to the genus *Cannabis* in the family *Cannabaceae*.⁵ Cannabis plants develop male and female flowers in separate plants (male and female plants). Once pollinated, a female plant can produce hundreds of cannabis seeds. The female plants have a higher content of psychoactive substances and their products are more attractive to drug users.

8. The geographical origin of cannabis species is Central Asia, but after centuries of cannabis use for a wide range of purposes, cultivation of cannabis plants has spread around the world and a large number of national and regional varieties have been developed. These varieties are often named after their geographical origin, such as the Afghan, Netherlands (“Nederwiet”), Pakistani or Thai varieties.

* *Source:* David T. Brown, ed., *Cannabis: The Genus Cannabis* (Amsterdam, Harwood Academic Publishers, 1998); and Robert Connell Clarke, *Marijuana Botany: An Advanced Study—The Propagation and Breeding of Distinctive Cannabis* (Oakland, California, Ronin, 1981).

⁵ Potent cannabis varieties descend from one or more of the three major cannabis species, *Cannabis sativa*, *Cannabis indica* and *Cannabis ruderalis*. This breakdown is very popular in grey literature, but does not have full acceptance in scientific literature (see Karl W. Hillig, “Genetic evidence for speciation in *Cannabis* (*Cannabaceae*)”, *Genetic Resources and Crop Evolution*, vol. 52, No. 2 (March 2005), pp. 161-180).

9. The cannabis plant can be reproduced by planting seeds or by taking live cuttings from an adult plant, which are then planted into soil or a special medium that stimulates the growth of the roots (cloning). The development of highly potent varieties by cross-breeding or hybridization is a specialized task and requires a knowledge of genetics to obtain strains with stable characteristics. Female plants are used for illicit production of cannabis since they give a resin that is rich in active substances such as THC and other cannabinoids. The levels of these substances are especially high in the flowers of female plants.

10. Cannabis plants yield two products, cannabis herb (marijuana) and cannabis resin (hashish). “Cannabis herb” refers to the flowering tops of the cannabis plant from which the resin has not been extracted. “Cannabis resin” is made by extracting the crude or purified active substances (THC and other cannabinoids) from the cannabis plant.⁶

11. Flowers of female plants that have not been pollinated (and are therefore seedless) have a higher THC concentration than seeded flowers. The cannabis herb from seedless flowers is known as *sinsemilla* and contains significantly higher concentrations of THC than herb from pollinated plants — up to more than 20 per cent. Pollination of plants is avoided by strictly separating female plants from male plants, conditions that can easily be achieved in a controlled indoor environment.

12. Cannabis plants usually start to flower when the daylight time is decreasing and the period of dark exceeds 11 hours per day. Changes in daylight are therefore an important factor for cannabis grown outdoors, while indoors, artificial lighting can imitate seasonal changes and can be used to induce flowering. Cannabis plants die soon after flowering, but indoor plants can be kept alive indefinitely using artificial light to prevent the plants from flowering in order to use them for taking cuttings.

13. Cannabis seeds themselves do not contain any THC, but some traces of THC-containing resin from the flowers may be found on the outside of the seed.

III. The role of cannabis seeds in different forms of illicit cultivation of cannabis

A. Traditional field cultivation and modern methods of cannabis cultivation

14. Illicit cannabis products result from different cultivation methods. A major distinction can be made between “modern” and “traditional” methods of cultivation. Modern production differs from traditional production in many important aspects, including in the role of seeds in cultivation. Table 1 presents a comparison of some

⁶ Single Convention on Narcotic Drugs of 1961 (United Nations, *Treaty Series*, vol. 520, No. 7515), article 1 (d).

typical attributes of “low-tech”, or traditional, illicit cannabis cultivation and “high-tech”, or modern, cultivation (updated from Szendrei, 1997).⁷

Table 1

Comparison of typical attributes of traditional and modern cannabis cultivation methods

	<i>Traditional cultivation</i>	<i>Modern cultivation</i>
Plant	Long-standing, traditional varieties.	New varieties, improved by breeding and selection.
Role of seeds	Plants are grown directly from seeds; seeds are obtained from previous harvests.	Plants are usually grown from cuttings rather than seeds; seeds are used by special segments of cannabis growers.
Cultivation	Low technological requirements. The area under cultivation is comparatively large and depends on the availability of land (rural areas) and labour. Traditional cultivation and processing practices, grown with other crops. Minimal changes in cultivation practices over time.	Special information and technology are needed. The scale of production sites varies from a few plants (home-grown) to large growing operations with several 100 plants; production sites in urban areas are often indoors. Technologically advanced practices; dissociation from traditional agriculture. Increasing sophistication and commercialization of production.
Yield	Low to moderate (mainly one harvest per year). External limitations (soil, climate).	High (up to four harvests per year indoors). Internal limitations (plant physiology).
Products	Cannabis resin, hashish oil and low-potency cannabis herb of varying quality. No standardized quality.	High-quality cannabis herb grown under controlled conditions; a large variety of products with different psychoactive effects and flavours (“stoned” or “high”, <i>indica</i> or <i>sativa</i>). Identical plants with predictable features. Commercial products of more reliable quality.
Occurrence	Concentrated in Africa, the Americas and parts of Asia.	Technologically advanced countries, mainly in North America, Asia and Oceania, and Europe.

B. Cannabis seeds in traditional field cultivation

15. The main sources of information on rural, or traditional, cannabis cultivation techniques are the UNODC cannabis surveys conducted in Morocco (2003, 2004 and 2005) and Afghanistan (2009, 2010 and 2011).⁸ In both countries the main end

⁷ K. Szendrei, “Cannabis as an illicit crop: recent developments in cultivation and product quality”, *Bulletin on Narcotics*, vol. XLIX, Nos. 1 and 2 (1997) and vol. L, Nos. 1 and 2 (1988) (United Nations publication).

⁸ All the reports on these surveys are available from www.unodc.org/unodc/en/crop-monitoring/index.html.

product is cannabis resin, but the production methods and the role of seeds do not differ significantly in the case of cannabis herb.

16. Cannabis seeds are a side product of cannabis production in traditional field cultivation sites and cannabis farmers normally have a surplus of seeds after harvesting their cannabis plants.⁹ Some of that surplus is stored for sowing in the next cultivation period. The rest is traded, used as animal feed (e.g. for chickens) or for making products such as cooking oil. Cannabis seeds are also edible for humans. If a farmer needs seeds for new cannabis cultivation, other farmers in the village may provide them or they may be purchased at informal or local markets.

17. Seeds are also used as a means to propagate certain well-performing cannabis varieties. Reports from Afghanistan and Morocco indicate that farmers select their best plants for the seeds, thus improving the genetic characteristics of their plants, which are then more productive. High-producing varieties are often shared and traded within the village and at local markets.

18. The selection of the best plants has led to the development of a broad range of varieties often named after the place of origin; in Morocco two varieties of cannabis from Morocco and Pakistan were combined, producing a new variety that gives a slightly more golden colour to the resin.

C. Cannabis seeds in modern indoor and outdoor production

19. Modern illicit cannabis production is carried out on different scales using modern and commercially available technology. Modern production methods are different from traditional farming in terms of type of production site, production methods and use of technology.

20. The size of production sites — both indoors and outdoors — ranges from a few plants grown in flowerpots for personal consumption to highly professionalized production sites of up to 1,000 plants (indoors) and up to tens of hectares outdoors. How seeds are used and traded depends on the size and characteristics of the producer, the cannabis grower.

21. Inspired by Hough and others (2003)¹⁰ and Bovenkerk and Hogewind (2002),¹¹ the following classification of cannabis growers distinguishes between three types of grower, who may grow outdoors and/or indoors depending on the local climate, the availability of space and the perceived risk of being identified by law enforcement.

⁹ The yield surveys undertaken by UNODC and the Ministry of Counter-Narcotics of Afghanistan showed that the average seed yield was between 12 and 28 kg/ha harvested from the fields. The average amount of seed needed for sowing was between 2.5 and 3 kg/ha.

¹⁰ Mike Hough and others, *A Growing Market: The Domestic Cultivation of Cannabis* (York, Joseph Rowntree Foundation and National Addiction Centre, 2003).

¹¹ Frank Bovenkerk and Willemien I. M. Hogewind, *Hennepeteelt in Nederland: het probleem van de criminaliteit en haar bestrijding* (Hemp cultivation in the Netherlands: the problem of criminality and law enforcement) (Utrecht, Willem Pompe Institute for Criminal Law and Criminology, 2003).

Table 2
Classification of cannabis growers using modern methods

<i>Typology</i>	<i>Description</i>
Sole-use growers/small home growers	Individuals who grow cannabis for personal consumption only, either to save money or for intangible rewards such as the enjoyment and satisfaction of growing a plant that has a specific taste and psychoactive effect or sharing the product among friends socially.
Large independent home growers	Individuals producing primarily for and selling to an established clientele, including wholesalers, for commercial purposes. They often grow full-time, but are not necessarily part of a large criminal network.
Industrial producers	Large-scale operators, often with well established production networks in agricultural areas or empty industrial buildings. They often have a large organization of individuals with clear divisions of labour and possible links to other criminal activities or networks.

22. Large independent home growers and industrial producers use cloning almost exclusively for the production of cannabis plants. The largest amount of cannabis produced with modern methods thus originates from clones of grown plants and not from seeds. However, seeds are used for starting new production lines. The use of cloning has several advantages: it is more cost-effective, faster and yields plants with features identical to those of the mother plant. Producing clones requires a certain degree of expertise.

23. Sole-use growers grow from seeds and from cuttings. To start cultivation, new seeds sold on the international market or clones, if available, are used. Seeds can be traded more easily than clones.

24. Both modern high-yielding seeds and clones are costly and are sold by the piece. Usually, cannabis seeds for sale through the Internet and in grow shops are more expensive than clones sold on the black market.

25. Self-production of seeds is possible. However, under controlled indoor conditions seedless cannabis herb (*sinsemilla*) is most often produced, which is more potent. Thus, seeds are not normally a side-product of modern cannabis cultivation. If a grower allows the plant to be pollinated to produce seeds, the offspring plants most certainly will not have exactly the same genetic characteristics as the original plant. New seeds would therefore need to be purchased for every production cycle. When clones are used, a single mother plant can be used for several years and many production cycles.

26. Even though the vast majority of plants used for commercial drug production stem from clones and not from seeds, cannabis seeds do play an important role in their function as providers and distributors of cannabis plant varieties. The market for specialized seeds targets small growers who want to start cultivation and large-scale cannabis producers who want to start a new production line with a new plant variety.

27. Many sole-use growers purchase seeds for cultivation because it is easier, guarantees a certain quality and allows the grower to choose between different flavours and effects. Keeping a mother plant to produce clones is too cumbersome and gives identical plants without any variation in flavour and effect. As with alcohol or tobacco, users and growers select cannabis strains not only for potency or yield, but also the quality of their effect (“stoned” or “high”, rapid onset or slow onset) and the flavour or the beauty of the plant. The idea of quality is exploited and fostered by commercial breeders and sellers of cannabis seeds, who target their marketing efforts specifically at such small-scale, sole-use growers.

28. There is evidence that growers obtain seeds from various sources: friends and acquaintances, self-supply, illegal markets, seeded cannabis herb, commercial seed vendors on the Internet or in grow shops (see Decorte (2010)).¹²

29. There exists a global market for high-quality, highly potent and high-yielding cannabis strains, which are internationally traded in the form of seeds. In many countries and regions where modern production is predominant, the available cannabis products are derived to a great extent from globally traded, commercialized seeds. (Even if the plants are propagated by taking cuttings, the original genetics of the plant are probably introduced by selected seeds.)

30. Commercial cannabis seeds can be purchased from all over the world; in countries where cannabis seeds cannot be purchased legally, postal and courier services are utilized to obtain the seeds for illicit purposes. This is facilitated in particular by the use of “stealth packaging” by seed suppliers, where seeds are placed in airtight vials and are sent in discreet standard envelopes to avoid seizure by customs.

31. The marketing strategies of commercial cannabis seed providers clearly target small-scale users, who seek high quality in their products, and this may act as an incitement to cannabis users to start their own cultivation. Furthermore, the emphasis on worldwide shipping and stealth packaging may encourage in particular potential growers in countries where cannabis seeds are prohibited or strictly controlled.

IV. The open market for commercially bred and marketed cannabis seeds

Market overview: supply of commercially bred cannabis seeds

32. The supply of the commercial cannabis seed market is managed by breeders, seed-producing companies and resellers of seeds:

(a) A *breeder* is a person or a group of persons who develop new varieties of cannabis plant by cross-pollinating existing varieties or by selectively choosing the best plants for reproduction;

(b) A *seed-producing company* is an economic entity behind the commercialization of seeds. Most companies sell their seeds under a specific brand,

¹² Tom Decorte, “Small-scale domestic cannabis cultivation: an anonymous web survey among 659 cannabis cultivators in Belgium”, *Contemporary Drug Problems*, vol. 37, No. 2 (2010).

with a specific name for each variety. For example, the company Sensi Seeds B.V. offers the variety “Sensi Skunk” (branded as “Sensi Seeds”) and the variety “White Skunk” (branded as “White Label”). The brands “Sensi Seeds” and “White Label” both belong to Sensi Seeds B.V., but have two distinct websites without obvious reference to Sensi Seeds B.V. Thus, two distinct brands can have two distinct websites although they are produced by the same company;

(c) Cannabis seeds are sold either directly by the seed-producing company and/or by *resellers*. Resellers offer a large number of different seed brands and can be further classified into “pure” seed sellers, who sell only seeds, and “grow shops”, which sell seeds as well as paraphernalia for consumption and growing. Online resellers either operate exclusively through the Internet or are the web presences of bricks-and-mortar grow shops.

33. Between 2011 and 2012 UNODC undertook research in several languages to study Internet sites offering seeds worldwide (see the annex for details of the methodology used). During the study, 197¹³ different seed brands were identified, 122 of which had a distinct operating website. The number of resellers is much larger and no global estimate can be provided. By looking at “official resellers” listed on brand websites, 51 resellers in 19 different countries could be identified, with the actual number of seed-selling shops expected to be much larger.

34. The occurrence of seed-producing companies seems to be concentrated in a few countries. The vast majority of the 122 operating websites could be traced back to two Western European countries (n=42, and n=39). Several other seed brands seem to be marketed from other European countries and North America. For 10 websites the country of origin could not be determined.¹⁴

35. It is important to note that there are also numerous cannabis seed producers in the United States of America, which do not appear in the counting, since the seed producers surveyed sell their seeds only to customers resident in the United States with a valid licence for medicinal use of cannabis.

1. Range of products offered

36. Bricks-and-mortar grow shops usually sell a wide range of products related to cannabis production and consumption, as well as specific merchandise such as posters, stickers or clothes. Webshops dedicated to a single seed brand, however, seem to offer cannabis seeds almost exclusively.

37. All cannabis seeds sold through the Internet fell into one of three categories: “regular”, “feminized” or “autoflowering” seeds:

(a) *Regular seeds* produce an almost equal number of male and female plants. In order to produce a good product for cannabis use from regular seeds, male

¹³ The reported numbers reflect brands, not seed-producing companies, so if one company owns more than one brand, double counting may have occurred.

¹⁴ In most cases the country of origin was determined by a postal address on the website. If this was not possible, the WHOIS protocol (see annex, footnote a) was used to identify the assignee of the Internet address. The country of origin refers only to the postal address listed on either the website itself or in the information provided on the address of the website (URL). It does not contain information on the nationality of the owners of the companies. See the annex for more details on the methodology used.

plants have to be identified and removed at an early stage to avoid pollination of the female plants;

(b) *Feminized seeds* are advertised to overcome this issue. These seeds are from specially treated plants. The treatment involves stressing a female plant to produce viable, genetically identical seeds without being pollinated by a male plant. This leads to female offspring only;

(c) *Autoflowering seeds* are cross-bred hybrids¹⁵ that start flowering independently of any change in the hours of daylight. Autoflowering cannabis varieties are of smaller size, yield less and contain less THC. The independence of the time of flowering from hours of daylight allows for more than one harvest per year outdoors and promises beginners an easy start with low-maintenance plants.

38. Most seeds offered are feminized seeds. In a sample of 697 seed varieties sold through the Internet, 60.5 per cent (n=422) were feminized seeds; 25.7 per cent (n=179) were regular seeds; and the remaining 13.8 per cent (n=96) were autoflowering seeds.

39. Almost all providers reported the expected time from seed to flowering and the expected yield per square metre (indoors) or per plant (outdoors) in grams. Information on expected THC content (percentage) and expected height was provided less frequently; in a very few cases the concentration of another cannabinoid, cannabidiol (CBD) (percentage) was reported.

40. Cannabis seeds are costly: prices for 10 seeds, range between €15 and €180 (about \$19 and \$230), with most prices lying between €50 and €70 (\$64 and \$90). Packages typically contain 5 or 10 seeds, but there are also packages with 1, 3 and 7 seeds (in particular for feminized and autoflowering seeds). Price per seed decreases with increasing package size.

41. As regards relationships between various properties and the price, the only price-determining factor is the type of seed — regular, autoflowering or feminized. The most expensive seeds are feminized seeds, followed by autoflowering and regular seeds. No relationship between price per seed, THC content, yield or yielded THC could be found. Hence, the price data did not imply a general pricing model for seeds that reflected yield or potency. Prices across countries did not differ significantly.

42. Table 3 presents an overview of the indicators discussed above, but it should be noted that these data are unverified information as reported by vendors. The validity of the information was not investigated in the framework of the UNODC study.

Table 3

Properties of cannabis varieties as reported by vendors

	<i>Mean values</i>		
	<i>Autoflowering seeds</i>	<i>Feminized seeds</i>	<i>Regular seeds</i>
THC (percentage)	14	18	17
Flowering period	66 days	64 days	66 days

¹⁵ Plants grown from autoflowering seeds are guaranteed to be all female as well.

	<i>Mean values</i>		
	<i>Autoflowering seeds</i>	<i>Feminized seeds</i>	<i>Regular seeds</i>
Height (indoor)	59 cm	89 cm	140 cm
Height (outdoor)	107 cm	177 cm	181 cm
Indoor yield of harvestable product	365 g/m ²	550 g/m ²	388 g/m ²
Outdoor yield	86 g/plant	592 g/plant	483 g/plant
Price per 10 seeds	€56/\$72	€67/\$86	€33/\$43

2. Marketing of seeds

43. There is a common approach to selling seeds through the Internet: cannabis products from the seeds are described with attributes commonly found in wine and tobacco advertisements. Cannabis varieties are marketed not merely for their psychoactive effects, but also for their taste and quality and the beauty of the plant. Cannabis is thus depicted as a product of enjoyment, lifestyle and pleasure.

44. The Seed Bank, a company that was a pioneer in the trade in seeds for potent cannabis plants and later became Sensi Seeds, described in its 1989 catalogue the advantages of seeds over cuttings as follows:

“The commercial benefit of cuttings is that the clone of a particular mother plant will generally stay the same, producing crop after crop of uniform, standardized plants, neither improving nor fading in quality. The problem is that this soon becomes boring, in particular for the connoisseur.”

The notion of the cannabis-consuming connoisseur was therefore from the very beginning part of the seed business and is still reflected in the way the products are marketed. Table 4 gives examples of how commercially sold cannabis seeds and varieties are presented by vendors.

Table 4

Common phrases used by vendors of cannabis seeds to describe the products that result from their seeds

<i>Typology</i>	<i>Description</i>
Taste/smell	Deep aroma, spicy and incense flavour; sweet and fruity; strong tasty pineapple aftershock; earthy spiciness of a hardy Crimean hash plant; the smoke is mild with subtle hints of white pepper; mild wild vanilla and lavender, accented with lemon and orange peel; sandalwood and aniseed; nutty, spicy, peppery <i>sativa</i> smell; reminiscent of a fine liqueur; berry flavour with a slight acid touch.
Beauty of the plant	Tough, fast and amazingly vibrant plants; solid, resin-encrusted flower formation; balances the finest features of soaring tropical <i>sativa</i> and voluptuous, earth-shaking <i>indica</i> ; frosting of sticky silver resin glands; could be mistaken for bonsai Christmas trees covered with sparkling decorative snow.

<i>Typology</i>	<i>Description</i>
Effect	Strong on body and mind; very relaxed; focused on the activity of the moment; all-inclusive sensation; smooth, buoyant high, carrying it to new and interesting places; allows the mind to shift down a gear as muscle tension eases; clear, uplifting <i>sativa</i> high; very social high; very cerebral high.
Potency	Less powerful, enabling casual cannabis cultivators to enjoy [...] without being blown away; lower in tetrahydrocannabinol (THC), with a high proportion of cannabidiol (CBD), ideal strain for users who prefer not to be overwhelmed; massive THC output and high CBD gives a powerful couch-lock effect; it's a devastating plant, for medicinal use, or just to knock down that friend, who's an "expert" on the issue; could even be dangerous.
Types of smokers	For demanding smokers and sybaritic people; weed scholars consider her unsurpassed; instant hit with discriminating smokers.

V. The size of the markets in cannabis seeds

A. Seizure data

45. Seizure data are often used as an indirect indicator in the estimation of flows of illicit substances, the underlying assumption being that supply follows demand. At the moment only a limited number of Member States report seizures of cannabis seeds to UNODC through the annual report questionnaire. In 2010, 31 countries reported a total of 25 tons of cannabis seeds seized. In 2009, only 4.4 tons were reported, with the difference due mainly to Mexico, which did not report in 2009, but was the main contributor in 2010.

46. According to Australian authorities, most cannabis seizures at the Australian border involved cannabis seeds, probably intended for cultivation within Australia. Colombia and Japan reported to the International Narcotics Control Board that much of the highly potent cannabis seized came from seeds purchased over the Internet.

47. In the absence of information on types of seizure, the extent of trafficking in cannabis seeds using postal and courier services cannot be estimated. It can be concluded that the international trade in seeds of potent cannabis varieties has reached significant levels. However, without a systematic and comprehensive monitoring of seed seizures, major flows and trading patterns cannot be identified.

48. Table 5 presents seizures of more than 100 grams of cannabis seeds reported to UNODC in 2010.

Table 5
Total seizures of more than 100 grams of cannabis seeds reported to the United Nations Office on Drugs and Crime in 2010

<i>Region</i>	<i>Country</i>	<i>Total seizures (kilogram)</i>	<i>Number of seizures</i>
Africa	Algeria	4.9	N/A
	Egypt	2.2	N/A
Asia	Korea (Republic of)	37.1	N/A
Europe	Albania	3.0	2
	Bosnia and Herzegovina	0.8	N/A
	Bulgaria	0.2	6
	France	22.0	299
	Greece	0.4	123
	Hungary	1.8	148
	Italy	3.2	N/A
	Portugal	7.0	84
	Spain	0.5	6
	Argentina	37.7	N/A
Latin America and the Caribbean	Brazil	240.8	43
	Cuba	0.2	N/A
	Guatemala	30.8	N/A
	Mexico	20 067.8	1 903
	Paraguay	4 285.0	N/A
	Peru	200.0	N/A
	Saint Kitts and Nevis	9.2	N/A
	Saint Lucia	0.2	N/A
	Uruguay	0.3	5
Oceania	Australia	21.9	3 556
	New Zealand	5.0	440

B. Supply of commercially bred seeds

49. In order to arrive at supply-based estimates of the size of the international market in cannabis seeds, UNODC attempted to gather data from businesses trading with commercially bred seeds. Data collection proved to be difficult: because of the closeness to illicit businesses, no commercial cannabis seed producers would disclose their sales volumes. Official company data from publicly available tax registries were not revealing either, as it was not possible to trace the revenue from seeds alone.

50. The estimation of regional or subregional flows is equally difficult. With the complex structure of seed producers, seed brands, and resellers, not even a crude estimate of the numbers of “original” producers, that is, single economic entities owning one or more seed brands, could be made.

51. Seeds are distributed via more than one channel. The number of resellers of branded seeds is much larger than the number of seed brands alone and the shops are geographically widespread. Thus, even if production estimates of commercially

bred seeds of sufficient precision were available, it would not be possible to estimate flows between Internet selling sites, reselling Internet sites and bricks-and-mortar grow shops.

52. It is, however, evident, that there are no geographical limitations in terms of the availability of seeds. Seeds can be shipped to every country (although not all sites ship worldwide). From examination of Internet bulletin boards, cannabis magazines and other specialized publications it is evident that cannabis seed breeders from various countries and regions advertise globally via the World Wide Web.

C. Demand-based estimates of the global demand for seeds

53. The global demand for cannabis seeds depends on the total cultivation of cannabis plants, the share of plants cultivated by traditional and modern methods, and the share of plants cultivated from seeds and not from cuttings. For 2008, the global area under cultivation with cannabis plant was estimated to be between 200,000 and 641,800 hectares, resulting in an output of between 13,300 and 66,100 tons of cannabis herb and between 2,200 and 9,900 tons of cannabis resin. These estimates were based on minimum and maximum levels of reported cultivation, production, seizures and user prevalence rates, and should be considered with caution as the data were fragmented, non-standardized and not always scientifically based.

54. Very little is known about the market shares of cannabis products by production method. Because of the spread of cannabis cultivation and the virtual absence of monitoring systems, precise estimates of regional levels of cannabis production are not available. However, even if the size of the demand for cannabis seeds for illicit cultivation cannot be estimated, several conclusions can nevertheless be drawn.

55. The international market for cannabis seeds has a very large potential customer base: almost everybody in the world who thinks of cultivating or already cultivates cannabis is a potential customer. A survey among regular users in the United Kingdom of Great Britain and Northern Ireland found that most of the respondents (63 per cent) had tried growing their own cannabis plants (Atha, 1997, as cited in Leggett, 2006).¹⁶ Some 34 per cent of cannabis growers had grown plants from commercially available seeds and 43 per cent had used seeds as at least one of their sources. Another 13 per cent used cuttings exclusively and 20 per cent used cuttings at least in part.

56. In a more recent web survey among small-scale growers in Belgium, Decorte (2010)¹⁷ found that 76 per cent of participants used seeds and 54 per cent used cuttings. Half of the respondents used coffeeshops as a supply channel for seeds (it was unclear whether the seeds were actually bought in the coffeeshop or whether they were derived from cannabis bought there) and 15 per cent used the Internet as

¹⁶ Ted Leggett, "A review of the world cannabis situation", *Bulletin on Narcotics*, vol. LVIII, Nos. 1 and 2 (2006) (United Nations publication, Sales No. E.08.XI.10).

¹⁷ Decorte, "Small-scale domestic cannabis cultivation".

their source of supply. Perälä (2009)¹⁸ found that in Finland, where the sale of seeds is prohibited, the Internet was a major source for obtaining cannabis seeds, but they were also purchased from other growers or shared.

57. As far as the international market in cannabis seeds is concerned, the two main trends of recent years have been the rises in importance of feminized and autoflowering seeds. These types of seed are favoured by beginning growers.

VI. Conclusions and recommendations

58. Cannabis can be cultivated in different environments and on a different scale, ranging from traditional outdoor growing to modern indoor plantations and varying by region and by subregion. How cannabis seeds are produced and used for initiating cultivation depends on the type of cultivation and the goals of the producer.

59. In traditional outdoor farming, the cannabis plants are grown by sowing locally produced seeds. Seeds are either self-produced by the farmer, shared among farmers or obtained at informal or open local markets. The market in cannabis seeds thus seems to be very similar to markets in seeds of other, licit and traditionally farmed crops.

60. In modern cannabis production, which is characterized by the use of technological advanced methods, most plants are produced by cloning in order to easily reproduce large quantities of a guaranteed type. Cannabis seeds do, however, play an important role as providers of plant varieties and thus different tastes and potencies. A global market in high-quality, commercially produced and marketed cannabis seeds exists and it specifically targets small-scale and sole-use growers. This market presents itself as a “market of quality”: seeds are costly and promise potent cannabis products with great variation in taste, strength and effect. Such seeds can be purchased in specialized shops and through the Internet, and are then shipped worldwide in small quantities and packaged discreetly so as to avoid seizure by customs.

61. In countries where modern cultivation techniques are predominant, high-yielding and potent cannabis varieties are commercially produced and play an important role in supplying the cannabis use market. This type of cultivation is alimented by commercial seeds as well as plant cuttings.

62. The international market for seeds is a global market where seeds produced in and marketed from North America and Europe can be purchased in all regions of the world. Moreover, web-based free translation and currency-converting services allow for easy targeting of different markets, breaking language barriers.

63. Seizure data are very limited and sporadic, which may be an indication of irregular monitoring of seed seizures, a low level of trade in seeds or low rates of interception.

¹⁸ Sanna Rönkä and Ari Virtanen, eds., *Finland Drug Situation 2009: New Developments, Trends and In-depth Information on Selected Issues* (Helsinki, European Monitoring Centre for Drugs and Drug Addiction and National Institute for Health and Welfare, 2009), p. 132. (Available from www.thl.fi/thl-client/pdfs/9bf86f3e-9b30-48a1-bc56-b32981cf0575.)

64. The impact of the trade in commercially produced cannabis seeds on the illicit cannabis market is at least twofold. Firstly, there is a direct effect caused by the provision of high-yielding and extremely potent cannabis strains that can be grown in adverse climatic conditions. This has the potential to affect traditional cultivation and cause a transition towards a market with modern techniques, higher yields and higher potencies. The second impact is indirect, since the trade in cannabis seeds helps to spread the “cannabis culture”, which has emerged around the consumption of cannabis and the cultivation of the cannabis plant. That culture manifests itself in cannabis magazines, cannabis clubs, campaign groups and cannabis fairs around the world, all of which aim at depicting cannabis as a lifestyle product. In that sense, marketing of cannabis plants can be compared with the marketing of tobacco, wine and other alcohol products, as it caters to different tastes and consumption preferences.¹⁹ In their own interest, cannabis seed producers and resellers seek to create and maintain a culture around the cannabis plant.

65. Cannabis fairs bring together producers and vendors of all the equipment necessary for cultivation and consumption: hydroponic systems, lights for growing plants and paraphernalia such as pipes, bongs and vaporizers. Producers, breeders and vendors come together, network and inform the public about the latest developments. Cannabis seed producers promote cannabis events and magazines by placing advertisements for their products.

66. The provision and advertisement of seeds that facilitate an easy start thus has the potential to foster the growth of the number of small-scale growers who supply their personal use and that of friends. The growing popularity of autoflowering seeds and feminized seeds, which make successful growing less sophisticated, may reflect the worldwide increase in sole-use growers.

67. Regular monitoring of the market for commercially bred seeds can shed light on such developments. In particular, the online market for commercially bred seeds is an open market that can easily be monitored on a regular basis. Indicators of the size of the cannabis seed market are the number of online seed-selling companies, numbers and spread of resellers, trends and developments in the products offered, and seizures by means of transportation.

68. In order to better understand the effects of the recent developments in cannabis markets worldwide and in particular in the more frequent occurrence of highly potent cannabis, which may pose a serious threat to human health, more detailed data need to be collected.

69. The Commission on Narcotic Drugs may wish to consider requesting UNODC, subject to the availability of extrabudgetary resources, to continue the research on the different methods of cannabis cultivation and the role of cannabis seeds therein in order to gain a better understanding of the effects of the commercialization of cannabis production.

70. The Commission may also wish to consider requesting Member States to monitor the sale of cannabis seeds, in particular through the Internet, on a regular

¹⁹ Like wine tastings, “cannabis cups” are events where the best commercially bred strains on the market are selected by participants who pay a certain fee: everybody who pays this fee is a judge. Such events directly promote seed companies and have a strong advertising effect: cannabis cup winners often feature largely on the websites of resellers.

basis and using existing tools such as the annual report questionnaire, in order to obtain more information on seizures and predominant methods of production of cannabis and cannabis seeds.

Annex

Methodology of the survey

1. The findings on the international market for commercially bred and sold cannabis seeds presented in this report are based on Internet research on the market for cannabis seeds. Qualitative information was also collected through 30 semi-structured interviews conducted during the 2010 and 2011 Cultiva Hemp Fair held in Vienna and the Expocannabis Sur in Malaga, Spain, as well as through telephone interviews with representatives of cannabis seed vendors and producers. Furthermore, grey literature on cannabis cultivation and cannabis-related information (such as Internet bulletin boards, videos, cannabis magazines and books on cultivation) was also studied.
2. As a result of the extensive Internet research, a total of 197 different cannabis seed brands advertised on the Internet could be identified (as at December 2011). Sources were websites of seed resellers (e.g. www.cannabis-seeds-bank.co.uk, a seed bank advertising on relevant Internet bulletin boards and offering 134 different brands at the time of writing) and community-based information sites that did not directly sell seeds, but collected information on seed producers and their strains. The search was conducted in several languages (including simplified Chinese, Dutch, English, German, Japanese and Spanish) and employed different search engines. However, it cannot be claimed that the data obtained are complete.
3. Different approaches were used to determine the country of origin of brands. In the easiest case the website had a contact address listed. Ownership and contact address might differ, but for the purposes of this market survey the country from which the company operated was considered. If there was no contact address available, the WHOIS protocol^a was utilized, which normally provides the contact information of the assignee of the domain name. Some registrars offered private registration, in which case neither the assignee nor the country of origin could be identified. The Internet protocol address of the web servers hosting the web page was not of use, as web space can be rented on servers located anywhere.
4. In a second step 45 seed brands were selected for in-depth analysis. The 45 brands consisted of exhibitors at one of four major cannabis fairs held in Austria, Canada, the Czech Republic and Spain in 2011 and 2012, and brands where up-to-date catalogues were available. Catalogues were retrieved from Austrian grow shops and the Cultiva Hemp Fair. This selection process was based on the assumption that presence at a cannabis fair and in grow shops indicated a certain degree of size and market reach.

^a L. Daigle, "WHOIS Protocol Specification" (September 2004). Available from <http://tools.ietf.org/html/rfc3912>.