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## Hemp (*Cannabis sativa* L.) Cultivation in the Tai'an District of Shandong Province, Peoples Republic of China

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This paper summarizes the history of hemp (*Cannabis sativa* L.) cultivation and traditional use in the Tai'an District of Shandong Province in the People's Republic of China, and investigates the cultivation and processing techniques currently being employed to produce hemp ribbon and hemp seed. Recent production levels and market conditions are reviewed. Comparisons with Hungarian hemp cultivation and processing, being representative of Western hemp production, are provided where appropriate. Wild types and escaped plants are also described.

### Introduction

Hemp is cultivated for its strong bast fiber throughout many of the numerous fertile inland valleys of Shandong Province, Peoples Republic of China. Hemp cultivation in China dates back more than 5,000 years and according to local legend, the peasant farmers of Shandong Province have grown hemp for more than a thousand years. Hemp is produced almost entirely by ancient traditional methods and local hemp farming practices have been influenced very little by modern Western techniques. However, a modern hemp degumming, spinning, and weaving mill was constructed in the village of Dong Ping in Tai'an District in 1987. In 1993, a Chinese-Dutch joint venture



**Figure 1.** Shandong hemp farmers use traditional methods to grow and process their crop.

invested in the hemp mill and began to influence the local cultivation, market structure, and processing of hemp. This article documents the traditional hemp farming practices and current market situation, especially with reference to the sudden and rapid changes brought about through the influence of Western agricultural advisors, modern cultivation equipment and the introduction of improved hemp varieties.

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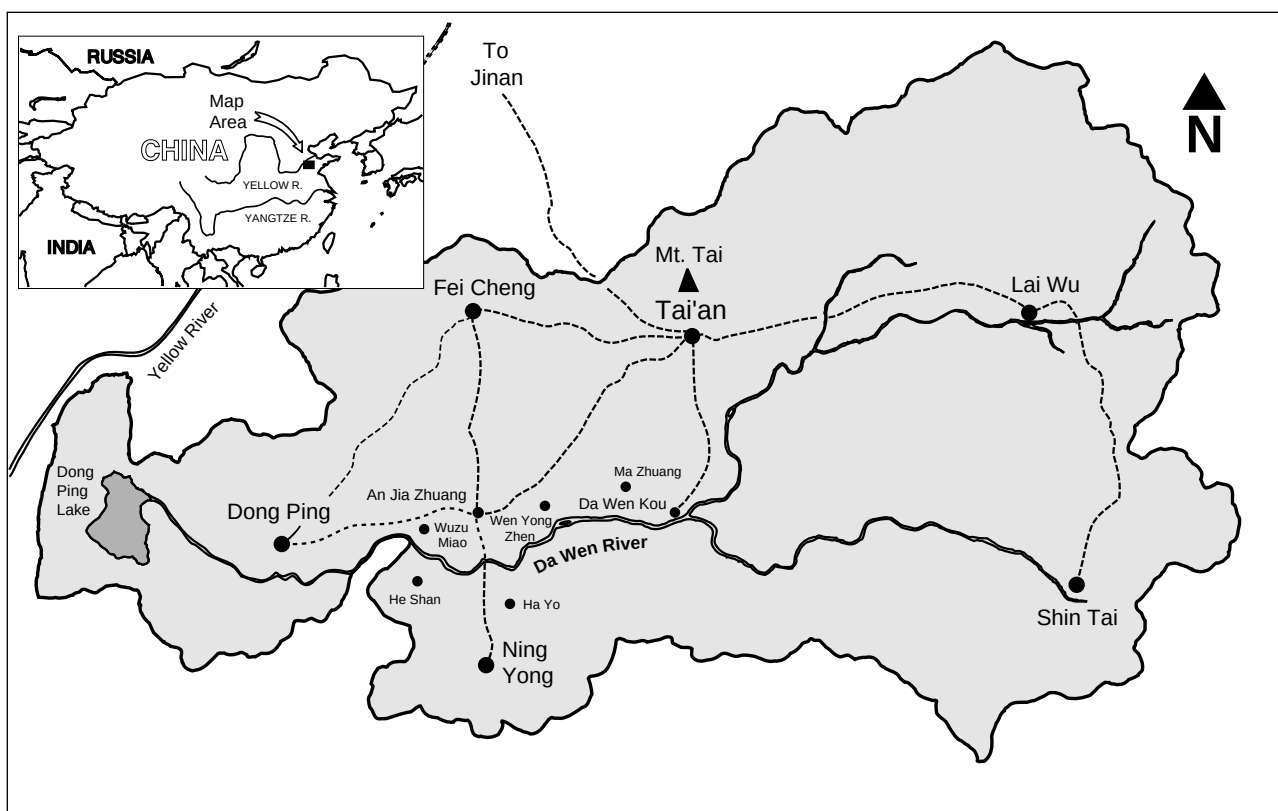
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## Shandong Province

Shandong Province is located along the central coast of eastern China (see Fig. 2) and has a continental climate. Summers produce heavy rain and average  $21^{\circ}\text{C}$  temperatures. Autumn weather is clear and sunny with an average temperature of  $10^{\circ}\text{C}$ . Winters bring several snowfalls and average minus  $4^{\circ}\text{C}$ . Spring is often foggy or rainy and the temperatures average  $11^{\circ}\text{C}$ .

The city of Tai'an is located in west-central Shandong Province and is situated at the foot of Tai

outcrops. This perhaps results from the ancient Taoist tradition of offering grain to the Jade Emperor atop Tai Shan peak during the Double Nines Festival held on the ninth day of the ninth month of the Chinese calendar. Taoists consider the Jade Emperor to be the Supreme God of Heaven and spread offerings of grain so that the birds will carry their prayers and praises to the deity. New seeds are therefore brought to the mountain regularly. These escaped plants are of shorter stature (1-2 meters) than cultivated varieties and have brown



**Figure 2.** Tai'an District, Shandong Province, P. R. C.

Shan, the most revered of the five sacred mountains of ancient China. Chinese mythology says that Tai Shan represents the head of Pan Gu, the mythological creator of China. His four limbs form the remaining four sacred mountains in North, South, West and Central China. The Chinese have made pilgrimages to Tai Shan for several millennia, believing that the mountain has power over Heaven and Earth, of which the summit is held to be a manifestation. Confucius ascended to the summit several times, over 2,000 years ago, as have many Chinese emperors. Millions of devout Buddhist and Taoist Chinese have climbed the more than 7,000 stone steps to the summit; lighting incense, leaving offerings and praying at the dozens of shrines, temples, and carved stone calligraphies along the way.

As one approaches the summit of Tai Shan, *Cannabis* can be seen growing spontaneously with increasing frequency along the sides of the paths. The mountain top is nearly covered in weedy hemp that has escaped cultivation and grows throughout the rocky

seeds and medium sized leaves. Their reduced stature and seed size likely result from the harsh climate of Tai Shan, but in other respects they are very similar in appearance to the locally cultivated hemp varieties.

A different spontaneously occurring variety of *Cannabis* is found on the north side of Tai Shan far from the influence of religious pilgrimage. This "wild" (naturally occurring without the influence of cultivation) variety is characterized by very short stature (less than one meter), reduced leaves with narrow leaflets, tiny dark seeds, and a very compact and highly branched growth form, even when crowded together. Some populations also have very red stems. Wild *Cannabis* flourishes on the rocky fringes of the highest terraced fields in the disturbed zone between cultivated lands and mountain slopes, along paths and roads, and in the shade of trees where no crops are planted. Spontaneously growing escaped and wild *Cannabis* does not survive as an intrusive weed in cultivated fields since it is removed by local farmers.

| Phenotypic characteristics | Mt. Tai Shan 'wild'                                                            | Mt. Tai Shan 'escaped'                               | 'Lai Wu' 'landrace'                                                   | 'Fei Cheng' 'landrace'                                         |
|----------------------------|--------------------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------|
| <b>Leaf shape and size</b> | light green highly reduced leaves; 1-5 narrow leaflets w/ many fine serrations | light green small and narrow                         | medium green; 7-9 medium leaflets w/ more serrations                  | dark green; 7-9 large broad leaflets w/ fewer serrations       |
| <b>Stalk height</b>        | very short (0.2-1.0 m)                                                         | short (1.0-2.0 m)                                    | medium (2.5-3.5 m)                                                    | tall (3.0-4.0 m)                                               |
| <b>Internode length</b>    | very short (1-5 cm)                                                            | short (5-10 cm)                                      | medium (10-15 cm)                                                     | long (15-20 cm)                                                |
| <b>Branch development</b>  | highly branched compact growth                                                 | sparsely branched                                    | many long branches                                                    | few short branches                                             |
| <b>Flowering commences</b> | very early (June)                                                              | early to late (July and August)                      | early (males = July 20-25) (females = August 10-15)                   | late (males = August 10-15) (females = August 25-30)           |
| <b>Stem diameter</b>       | very small (2-6 mm)                                                            | small (5-10 mm)                                      | medium (10-30 mm)                                                     | large (15-40 mm)                                               |
| <b>Seed description</b>    | dark brown (nearly black) w/ abscission layer                                  | brown or gray w/ or w/o pattern w/o abscission layer | light-colored seeds w/ dark longitudinal stripes w/o abscission layer | and large brown seeds w/ marbled patterns w/o abscission layer |
| <b>Seed size</b>           | very small (1,000 seeds=4 gm)                                                  | small (1,000 seeds=10 gm)                            | small (1,000 seeds=12 gm)                                             | largest (1,000 seeds=26 gm)                                    |
| <b>Seed maturation</b>     | very early (late July to early Aug.)                                           | early (Aug. -Sept.)                                  | medium early (September)                                              | late (late Sept. - early Oct.)                                 |
| <b>Sexual type</b>         | dioecious                                                                      | dioecious                                            | generally dioecious *                                                 | dioecious                                                      |

(\*some male plants start out as female at first nodes, but change to purely male as flowering continues)

**Table 1.** Phenotypic differences between the spontaneously growing wild and escaped populations and the cultivated small-seed and large-seed landrace types of the Tai'an district.

In the Tai'an district, the landrace variety is referred to as either "Lai Wu" or "Fei Cheng" hemp, named after the famous eastern Lai Wu and central Fei Cheng hemp producing counties of the Tai'an District. Little if any intentional human selection has occurred and the evolution of the landrace has been directed almost entirely by unconscious selection by farmers and by natural factors. No special selection for crop improvement is exercised by farmers.

### Cultivated Plant Description

The Shandong land race of *Cannabis* hemp is almost entirely dioecious. Plants are generally moderately branched and 2.5-4.0 meters in height. The foliage is medium to dark green and the leaves have 7-9 leaflets. The inflorescences are relatively sparse and seed yield is low compared to improved European varieties. Although some individuals elaborate resin glands, they apparently produce little if any of the primary psychoactive cannabinoid THC, and the local landrace cannot be considered a drug variety. There is no local tradition of its use as either medicine or inebriant. The physical characteristics of the seeds of the cultivated *Cannabis* of

the Tai'an District fall into two groups; small light-colored seeds (1,000 seeds=12.0 gr.) with dark longitudinal stripes, and large brown seeds (1,000 seeds=26.0 gr.) with marbled patterns. Local agricultural officials report that the small-seeded variety is 'Lai Wu' and the large-seeded variety is 'Fei Cheng'. Apparently the 'Lai Wu' and 'Fei Cheng' varieties have been traded back and forth throughout the Tai'an District for years.

Both of these seed types are derived from segregation of the local landrace. They originate from the same fields and both were found to be equal in bast content (8-15% d.w.). About 65% of the plants in any given population are large-seeded, about 20% are small-seeded, and (based on seed characteristics) only about 15% seem to be hybrids between the two, although the two varieties are cultivated in the same fields. Few hybrids are observed because the two varieties flower at very different times. The hybrids likely occur only between late flowering females of the small-seed variety and early flowering males of the large-seed variety. It would be very unlikely for males of the small-seed variety to hybridize with females of the large-seed variety since the small-seed males have ceased to shed pollen long before the large-seed females are receptive.

Several additional marked phenotypic differences are exhibited that must reflect underlying genotypic differences (see Table. 1).

The characteristics associated with the small-seed cultivated landrace could result from its breeding with a local wild variety, but this seems unlikely because the geographical ranges and flowering times of the wild populations do not coincide with the cultivated landraces. It is more likely that either the small-seed landrace is introduced from more northerly latitudes, since it matures early, or that the large-seed landrace is introduced from more southerly latitudes, since it matures late. Local hearsay has it that hemp varieties were introduced from southern China, but this could not be verified with agricultural officials. Introductions of small amounts of

throughout the Tai'an area in several counties where it is no longer cultivated today. During this time the region surrounding Lai Wu in eastern Tai'an District was considered to produce the tallest and finest hemp in Shandong Province. Very little hemp is grown in Lai Wu today and the vast majority of the hemp is grown in Fei Cheng and Ning Yong Counties. By 1992 no more than 10,000 tons of hemp ribbon were produced in Tai'an District on less than 10,000 ha. The decline in hemp production resulted from diminished markets for hemp products and the low prices for raw hemp ribbon in comparison to other crops. Farmers feel they can earn more money from food crops such as wheat, maize, soy beans, peanuts, fruits, and vegetables.

In Dong Ping County, approximately 1,600 tons of

| <b>Broadcast Sown</b>                |                                      |                                   | <b>Sown in Rows (10-15 cm spacing)</b> |                                      |                                   |
|--------------------------------------|--------------------------------------|-----------------------------------|----------------------------------------|--------------------------------------|-----------------------------------|
| <b>Quality level</b>                 | <b>Avg. No. stalks/m<sup>2</sup></b> | <b>Percentage of each quality</b> | <b>Quality level</b>                   | <b>Avg. No. stalks/m<sup>2</sup></b> | <b>Percentage of each quality</b> |
| First (tall)<br>(2.5+ m)             | 34                                   | 27                                | First (tall)<br>(2.5+ m)               | 88                                   | 44                                |
| Second (med.)<br>(1.5-2.5 m)         | 39                                   | 31                                | Second (med.)<br>(1.5-2.5 m)           | 61                                   | 30                                |
| Third (short)<br>(< 2.5 m)           | 53                                   | 42                                | Third (short)<br>(< 2.5 m)             | 54                                   | 26                                |
| <b>Total</b><br>(No/m <sup>2</sup> ) | <b>126</b>                           | <b>100</b>                        | <b>Total</b><br>(No/m <sup>2</sup> )   | <b>203</b>                           | <b>100</b>                        |

**Table 2.** Variations in stalk quality (length) between broadcast-sowing and row-sowing.

seed from Japan also may have been made many years ago for the local production of woven burial shrouds. Exchange of seed between counties within the Tai'an District is also common. Although the stalks of the small-seeded variety have a bast percentage equal to the large-seeded variety, they are shorter, so the overall yield is lower. Therefore, the farmers claim to prefer the large-seed variety. Despite this sentiment the small-seed variety is still present in the fields and consistently comprises approximately 20% of the population. This is one explanation for the lack of uniformity in local hemp crops that result in uneven competition within stands and for the production of many different height stalks. This difference in height is especially apparent in the Autumn harvest season since the upward growth of small-seed plants is slowed due to their earlier flowering.

### Extent of Hemp Cultivation

In the 1970s and early 1980s, Shandong Province produced more than 100,000 tons of hemp ribbon annually. (Hemp ribbons are strips of bark peeled from the outside of the stalks that contain bast fibers.) The author's estimates, based on interviews with local agriculture officials, indicate that the Tai'an District grew about 65,000 ha annually and produced about 60,000 tons of ribbon which accounted for about 60% of the production of Shandong Province. Hemp was widely grown

hemp ribbon were produced in 1992, and about 625 tons were bought by the Dong Ping Heavenly Hemp Textile Mill. The remaining 975 tons bought by the company came from the other hemp producing counties of Fei Cheng and Ning Yong and the Tai'an Urban District within Tai'an District.

In 1993, the Dong Ping Heavenly Hemp Textile Mill purchased 1,600 tons of hemp ribbon from farmers in the Tai'an District. This represents the production from about 1,500 ha. The total amount of land planted in hemp in Tai'an District in 1993 was estimated by local agricultural officials and hemp mill representatives to be approximately 5,300 ha. These estimates may be somewhat high. Estimates based on local data collected by interviewing village leaders and agricultural advisors, and the trends extrapolated from these data, lead to the conclusion that closer to 4,000 ha of land was used to grow hemp in 1993.

The remainder of this study concerns recent hemp production in Tai'an District along the Da Wen river south and west of Tai'an city. This area includes Dong Ping County (south and east of Dong Ping Lake), Tai'an Urban District (near the villages of Da Wen Kou and Ma Zhuang), Ning Yong County (near the villages of He Shan and Jiang Ji), and Fei Cheng County (near the villages of Wen Yong Zhen and Wuzu Miao).

## Field Conditions

The growing season for Spring hemp extends for approximately 110-120 days from late March (Spring Equinox) through July (Seasons of Slight and Great Heat). The Spring crop reaches canopy stage at 1.0-1.5 meters by the middle of April. The Summer crop is planted in middle June (Season of Grain-in-Ear) and harvested in late August (Season of Limit of Heat) or early September (Season of White Dew). Spring hemp is regularly irrigated. Farmers of Summer hemp rely on Summer rains to irrigate their crop. Irrigation from numerous wells is often provided several times during the growing season. (This is in contrast to the single Hungarian hemp season that extends from May through August, during which the crop is never irrigated.) Much more land would be available for hemp cultivation if hemp was to rival maize or soy bean as the major Spring and Summer crop. Only significant economic incentives for farmers will revive hemp production in Tai'an District.

The soil type in this area is a coarse sandy clay with very few small rocks. It drains readily and most of the fields appear healthy and productive. The soil south of Dong Ping Lake is heavier than the soil in Fei Cheng and Ning Yong Counties, drains more slowly, and is subject to flooding. Hemp is grown primarily on the rich flat-bottom valley land along the Da Wen river and very little is grown in the terraced foothill fields.

## Cultivation Techniques

Seeds of the local landrace are reproduced each year from remnant seed saved by the farmer. There is no intentional selection by the farmers, except possibly for the large-seed characteristic, and there are no imports of improved seed from other regions of China.

Seed is traditionally broadcast by hand at a seeding rate of 75 kg/ha for hemp fiber production and the resulting stand density ranges from 118-133 plants/m<sup>2</sup>. (Hungarian hemp farmers usually sow from 70-85 kg/ha depending on the seed size and viability. Nearly 400 seeds are sown/m<sup>2</sup> resulting in 150 to 200 stalks/m<sup>2</sup> at harvest) In recent years, at the suggestion of local agricultural advisors in Wen Yang County, a few fields were sown by planting in rows approximately 10-15 cm apart rather than by broadcasting. In this case, the same sowing rate was used but the stand density ranged from 187-215 plants/m<sup>2</sup>. (Average Hungarian hemp fields are planted in rows 12 cm apart.)

The average yield/m<sup>2</sup> of stalks was increased by 60% and the average percentage of first quality fiber was also increased by 60% by planting in rows. This results from the increase in surviving stalks when seeds are sown in rows, rather than broadcast (Table 2).

Fertilizers are applied before sowing and when the crop is about 50 cm tall. Various animal manures (15-60 tons/ha) and soy bean meal (up to 1,500 kg/ha) are spread on the fields and plowed or spaded under in the Spring well before sowing. Mixtures of chemical fertilizers are commonly used at a total application rate of up to 1,000 kg/ha.

The hemp crop is harvested in its entirety before the plants begin to flower, approximately 100-120 days from sowing. Plants range in height from 1.5 to 3.5 meters. The average height of healthy stands of hemp is 2.5 meters. The majority of plants have ceased rapid stalk elongation as they approach flowering. Upon close observation a few of the plants can be sexed at harvest in middle July (Season of Slight Heat), but none have begun to flower.



**Figure 2.** Bundles of hemp stalks retting in a pond.

(Hungarian hemp is harvested when it begins to flower and the male plants shed pollen, but very few viable seeds form before the hemp is harvested in late August.)

Since hemp is harvested before it flowers, no seed is produced. Seed is produced either in fields intentionally sown for seed, or from plants growing along the margins of fields, on the banks of irrigation ditches or along roadsides. Seed crops are planted in late May (Season of Full Grain) or early June (Season of Grain-in-Ear) with the rows spaced approximately 50 cm apart. Seed plants are harvested in the middle of October (Season of Cold Dew).

Only one insect pest seems to cause economic damage to the Spring hemp crop. A small shiny black jumping flea-beetle infested all of the fields to varying degrees. Few fields were uninfested. In fields where less fertilizer was used, and crop growth was not quite so vigorous, the beetle infestations reached tremendous levels, and they skeletonized all of the leaves on every plant. The beetles must certainly lower yield, but it was difficult to determine by how much, since the only fields to be seriously attacked were those where little fertilizer was applied, low nutrient levels also decreasing yields dramatically. Farmers report that the flea beetles only cause damage late in the crop cycle during the last month

before harvest, and that the fields harvested last have the worst infestations of flea beetles. Seed crops maturing in the Autumn are plagued by leafhoppers, caterpillars, aphids, and many other common agricultural pests.

Hemp fields are planted so thickly that weeds are shaded by the dense canopy and crowded out. Weeding is only necessary in widely spaced seed gardens. No herbicides or insecticides are used on hemp in Tai'an District since they are expensive and few pests threaten to cause serious economic damage.

## Hemp Processing

The hemp crop is harvested by cutting all of the stalks at the soil line with a short-bladed sickle, taking care not to pull up any roots. Bits of root attached to the ends of the ribbons lower their quality and must be removed later by hand at the mill. Dry soil is more convenient for harvesting because the shallow roots stay in the ground rather than pulling out. Branched plants at the margins of the fields are usually discarded or occasionally saved for seed production.

The plants are graded by pulling out the longest stems of highest quality first. The top projecting leaves of the bundles are pulled to first select the longest stalks and then the medium length stalks of second quality are removed. The short and twisted stalks of third quality are taken back to the village for domestic use, such as laying crude twine and rope, and do not normally enter into commerce. The leaves are stripped from the graded stalks with a long field knife before drying.

The three grades of stalks are separated and laid out in the sun in a single layer across the empty harvested field for 2-4 days until they are partially dried. (The Hungarians dry the stalks completely and ret either in the Autumn or the following Spring and Summer after the weather warms.)

The partially dried stalks are then bundled together approximately 200 at a time and immersed in a pond, stream, or brick tank for 1 to 3 days of retting. The bundles are turned twice a day in ponds or streams, or weighted down with stones and timbers in retting tanks, to keep them wet. Since the stalks are still somewhat moist, and do not float as buoyantly as completely dried stalks, they need not be weighted so heavily. The retting water is from 23° to 30° C. depending on the depth of the water and its exposure to direct sunlight. (Hungarian retting takes a week or ten days in much cooler water, or only a few days in warm geothermal water.) After the brief retting the stalks are again laid out on the field in a single layer and partially dried in the sun for 2 to 3 days. If the initial retting was insufficient to free the fibers the stalks are sometimes retted a second time and partially dried again.

At this point, the stalks can be processed by two different methods. The most common is the wet-method in which the stalks are partially dried and then stripped of their fibers by hand. Small bundles of these bast fiber ribbons are then tied together near the basal end and dried on lines in the sun. After they are thoroughly dried for several days, the smaller bundles are tied together, ten at a time, and bundled

tightly for market. This wet-method allows the farmer to market his hemp very quickly.

However, a very few farmers dry the stalks completely and store the dried stalks until later in the Summer or Autumn. They then break the dried stems and comb the ribbons to remove the woody hurds by the typical Western dry-method. The yield of salable ribbon by the dry-method is approximately 10% of total dry stalks, while the yield of salable ribbon by the wet-method is approximately 8% of total dry stalks. Dry-method hemp is of slightly higher average quality than wet-method hemp, and as there is far less dry-method hemp, it commands a slightly higher price at market. Bast fiber content of plants of the local landrace saved for seed production ranged from 5-22% and averaged 12%. (Improved Hungarian varieties yield from 30-35% bast.)

Apparently the dry-method was initiated in 1986 by request of the Dong Ping Hemp Mill, but it has not gained much popularity, as it requires specialized equipment. The mill uses mostly wet-method ribbon but prefers to use the less common dry-method ribbon. By 1995 almost all of the hemp ribbon was produced by hand stripping of partially dried stalks. Any technique that will make the farmer's work easier and free up their fields earlier, so they can sow another crop, is always favored and becomes the most common.

A good crop produces approximately 8-12 tons of dry stalks and 0.7-1.0 tons/ha of first and second quality (long and medium length) salable ribbon. (Hungarian hemp fields produce 7-10 tons/ha of dry stalks or approximately 2.5-3.5 tons/ha of ribbon.)

## Hemp Marketing

The quality and price of hemp ribbon are determined by its method of preparation, length, and moisture content. Long strands of well retted and dried hemp ribbon command the highest prices. The price of hemp ribbon is lowest in July and August when hemp fills the markets following the Summer harvest.

In July of 199, the farmers were being paid up to US\$ 0.60/kg for first-quality wet-method ribbon and US\$ 0.40-0.50/kg for second-quality wet-method hemp ribbon. By July 1994 it was reported that the farmer was being paid US\$ 0.75/kg for first-quality ribbon. The July 1994 harvest was delayed slightly by heavy rains during early July, but this also raised the total yield of hemp. In July of 1995 the market price of first-quality hemp ribbon had risen to nearly US\$ 1.00/kg.

## Seed Production and Marketing

Seed for the following year's sowing is obtained from two sources. The largest portion of the seed comes from fields that were planted for hemp seed production. The second source of seed is from spontaneously growing escaped roadside ditch plants that the farmers call "wild". Cultivated seed fields are usually sown in late May or early June (Seasons of Grain and Grain-in-ear) in clusters of 4-5 seeds at approximately 15-50 cm intervals in rows

approximately one meter apart in order to allow sufficient branch development and increased seed yield.

All of the seed plants have sparse inflorescences and even the most fecund have a fairly low average yield of seed (400-500 kg/ha) when compared to improved hemp varieties from eastern Europe (800-1,200 kg/ha). Roadside plants have very sparse flowers and even lower seed yield, due mainly to a lack of nutrients. The seed crop is traditionally harvested during the Season of Cold Dew and before the Season of Frost's Descent. This time falls approximately between October 8 and October 23.

The inflorescence is absolutely non-shattering and the seeds must be threshed from the plants during collection. This indicates that the Shandong landrace is fully domesticated. The seeds are very resistant to threshing unless the plants are fully dried. The seed is threshed from the plants in three stages. After the seed plants are harvested, they are stacked in pyramids and allowed to partially dry for 2-3 days before the first threshing. The plants are still fairly moist and supple at the time of the first threshing. Only the most mature seeds fall from the inflorescences as the whole plants are flailed against the ground. The first threshing produces the highest yield of the most mature and highest quality seed. The second threshing of the whole plants is done after the plants have had a few more days to dry and the less mature seeds can be freed more easily. The third and final threshing is performed a few days later when the plants have had time to thoroughly dry. The last of the seed is squeezed from the inflorescences by rolling them between the palms or by children walking barefooted on top of the plants. In each case the seed is dried in the sun for 2-3 days to ensure that it is sufficiently dry to be stored in rice sacks without spoiling.

The farmers keep a constant daytime watch and hang brightly colored cloth above the stacks of drying seed plants to prevent small sparrows from feeding on the seeds. Firecrackers are commonly used to scare flocks of feeding birds away from the seed fields. Seed plants are often transported to the farmer's home immediately after they are harvested to prevent further destruction of the seed by birds and rodents.

Some special cultivation techniques are used in hemp seed fields to increase yield. The tops of female plants are often removed as they begin to flower so they will grow more branches and consequently yield more seed. Sometimes up to 90% of the male plants are thinned at the time of early flowering to allow the female plants more room to branch and yield more seeds. The fiber of the highly branched male plants and seed plants is too coarse for textiles and is used by the peasants to make rope, binding twine, and other domestic products.

The majority of seed is bought by other local hemp farmers who require additional seed to grow their hemp fiber crop. The remainder is sold in Tai'an city for bird seed. Hemp seed usually sells for US\$ 0.75-1.00/kg. Maize seed costs US\$ 0.75-1.00/kg, soy bean seed costs US\$ 0.25/kg, and peanut seed costs US\$ 0.30/kg. Densely

planted stands of fiber hemp are sown at a rate of 75 kg/ha, while maize fields are sown at a rate of 10 - 15 kg/ha, so hemp is by far the most costly agricultural seed.

### Traditional uses

Shandong Province has a long history of folk uses for hemp. In today's open market most of the first and second quality hemp ribbon is sold for cash to suppliers and only the third quality hemp ribbon from short and twisted stalks is commonly used domestically. Sometimes the fibers are stripped from the stalks without retting or entire small stalks are twisted or braided together to make crude rope. The local peasants traditionally made twine, rope, sacking, burial cloths and other domestic items from the small stalks, ribbon and fiber. The small stalks are used directly for binding without any further processing, the hemp ribbon is twisted into twine, or the fiber is extracted and laid into rope. Hemp stalks are tied together to make crude walls for field shacks and are also lashed together in the garden for bean trellises and light fences.

Neither hemp seed, nor hemp seed oil, is commonly eaten in Tai'an district. This is in direct contrast to much of China where whole hemp seeds are eaten uncooked or roasted as snacks and oil is also sometimes pressed from the seed. The peasants around Tai'an say that if you eat too many hemp seeds (about 250 gr.) you will faint. The resin-covered bracts adhere tightly to the outside of the seed, and this may be the reason for this legend, even though the local landrace is only slightly psychoactive. Pigs and other farm animals eat the fresh leaves that are cut from the hemp stalks and seed plants before they dry completely.

Crude paper is occasionally made from the hurds or wood. Local paper factories include hemp hurds and hemp fiber to strengthen wheat straw paper. The hurds are most commonly used to start coal fires for cooking and heating.

A small specialty market also exists based on direct export of unprocessed hemp products to Japan. Raw fiber is used there for the hand spinning of fine textiles and specialty paper production. Japanese traders also buy a limited number of long straight hemp stalks for fireworks manufacture or for use as funerary offerings. Long straight clean stalks, peeled of their fiber are used in Japanese funerary rituals to show respect for the spirit of the deceased. In 1993 the farmers received (0.3 US\$/kg) for cleaned stalks.

### Conclusions

A comparative study of the historical and current techniques of hemp cultivation in the Tai'an District provides insights into the relatively unchanged practices of peasant farmers. More importantly, an understanding of these ingrained hemp farming and processing methods will allow advisers to make more appropriate suggestions concerning the modernization of local hemp production. Rapid changes in hemp farming and processing will follow in the wake of Western investment in local hemp production. Advisers must make educated decisions concerning the timely implementation of these changes.