



The Turnip (*Brassica rapa* L. subsp. *rapa*) in Eastern Tyrol (Lienz district; Austria)

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Research

Abstract

The turnip (*Brassica rapa* L. ssp. *rapa*), has been a very important crop in the Alps for centuries. Its main uses were food and fodder. The fermented turnips (**Ruebenkraut**) used to be, as was sauerkraut, a very important winter foodstuff. The importance of turnips in Alpine countries is shown by the fact that they were even shown on the coat of arms belonging to noble families. Today, however, only a few remaining farmers still grow and process turnips. These farmers were approached in 1997/98 within an ethnobotanical inventory and 2003/04 with semi-structured interviews covering agronomy, processing and trade, as well as the cultural context of the turnip. One farmer was chosen for in-depth interviews and participant observation during the cultivation and processing of turnips. The results show that the few remaining farmers still hold the full knowledge necessary to successfully produce fermented turnip, including soil management, sowing, crop management, harvest, storage, processing and the propagation of seeds. In the families, where production of lactic acid fermented turnips is economically important, this knowledge is still passed on to younger members of the family. The survival of the cultivation of turnip by a few farmers is closely related to the high local appreciation of the specific taste for fermented turnips whereas the various uses and different stories belonging to the cultural context of the turnip are in danger of disappearing from the region.

Introduction

The globalization of the economy, the worldwide free trade of agricultural commodities and changes in consumer behaviour have caused changes in patterns of agricultural production, processing, use and consumption of locally cultivated plant species, of varieties and of its cultural and social context. As a consequence many locally grown cultivated plant species that have been very well known

for centuries, their cultivars and the related local knowledge are in danger of disappearing or have already disappeared. One of these cultivated plant species, whose cultivation is decreasing constantly, is *Brassica rapa* L. subsp. *rapa* (henceforth called in this paper turnip).

In this paper we will present the history of this species in Central Europe and the results of our field research on local knowledge and local use-patterns on turnips in Eastern Tyrol (Lienz district; Austria). The paper aims to document farmers' local knowledge, knowledge that has survived only at a few farms, to draw the attention of the scientific community to this species and argue for further research, for *in-situ* and for *ex-situ* conservation of the germplasm and the related knowledge.

History

The domestication of the turnip has very ancient origins. The word **laptu** in ancient Assyrian dates back to 1800 B.C. (Oppenheim *et al.* 1973). The turnip is a very well known vegetable in the entire Middle East (Arab: **lift**, Per-

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sian: **salgham**). In Ancient Greece and Rome the turnip was an important domesticated crop plant. The Greek Theophrast (371 - 285 B.C.) called it **gongylis** and the Roman Columella (35 - 65 A.D.) distinguished between the cultivation and conservation by lactic acid fermentation of *napus* and *rapa*, saying that *napus* only forms a tender root, whereas *rapa* has a thick stomach. Plinius (23 - 79 A.D.) described the varieties in ancient Rome, showing that the turnip was a favourite crop in mountainous regions of the Apennine and the Northern parts of Italy (Wissowa 1997). One of the best witnesses for the importance of the turnip as a crop plant is the beautiful picture in the Dioscurides (Mazal 1999), a Byzantine book from 512 A.D. that was made in Constantinople for a princess. The turnip was clearly available at the marketplace. The oldest excavated turnip is from Sparta in Greece and shows the importance of this food plant for the Byzantine culture (Hather *et al.* 1992).

In the Middle Ages the turnip was a staple food plant. In the Capitulare de Villis, Charlemagne (around 800 A.D.) gives instructions on which crops had to be planted and had to be given to his court; among those listed is *napi*. Hildegard von Bingen (1098 - 1179 A.D.) uses the term *ruba* and Albertus Magnus (1193 - 1280 A.D.) distinguishes *napo* and *rapa* (Wissowa 1997).

The hand drawn editions of Tacuinum Sanitatis (Arano 1976) in Gothic miniatures dealing with the medical effects of food show beautiful pictures of rape and **napones**. In the herbal books of the 16th century one can realize how turnip forms vary. In his book called Herbal, Gerarde (1597) differentiates very clearly between turnips and **navews** (*Brassica napus*) adding excellent illustrations. A more detailed description of the history and development of turnips can be found in Reiner *et al.* (1995)

For the Alpine chain prehistoric evidences of *B. rapa* seeds are listed by Willerding (1986). The oldest were found at Neolithic sites in Switzerland. One finding in lake dwellings in Lake Zurich suggests that seeds were collected for planting. About 50 seeds were in a pot, which is too little to store for nourishment. On the other hand, there are few examples of larger quantities, which would be found if seeds were used to press oil. Tuberous roots of *B. rapa* were probably selected directly from the annual *Brassica rapa* subsp. *campestris* (L.) Clapham, which grew around settlements when agriculture began. Thus in the mountain chains of Europe the selection of the wild *B. rapa* for bulbing is probably older than the selection for seed. In areas with cold and long winters the tuberous roots could serve as a staple food and were kept as stock for the winter. In the following spring the plant continued to grow and produced seeds. Thus biennial cultigens could be developed.

This context is shown by an old legend about a farmer making a deal with the devil. The devil sitting on his field

claimed to sit on a treasure, which he would give to the farmer, if he would divide the harvest of the field for the next two years. The farmer promised for the first year the harvest above the ground and in this first year he grew turnips. The devil got the leaves, which were of no use. So for the second year the devil claimed the harvest under the ground. But in this year the farmer grew wheat and left the roots for the devil. The devil was enraged but gave the treasure to the clever farmer and went back to hell (Graber 1914).

According to Plinius (23 - 79 A.D.), (König 1995) the best varieties in Italy came from Amiternum and Nursia, two towns northeast of Rome in the mountains of Abruzzi. The turnip grew in misty, frosty and cool regions, which made the turnips even sweeter, whereas heat made them leafy. On the other side of the River Po the turnip was the third crop after grain and wine. This is also shown by many medieval works of art, e.g., the frescos in the Torre Aquila in Trento in the Southern Alps in Italy (Figure 1) (Castelnuovo 1987).

The importance of turnips in Austrian Alpine countries is shown by the fact that even nobles had turnips in their coat of arms. Leonhard von Keutschach was Archbishop of Salzburg from 1495 to 1510 in a very prosperous period of gold mining and salt production. The noble family of Keutschach had the turnip in their coat of arms (Figure 2). The citizens of Salzburg had the nickname **Leonhard der Ruebler** (literally, Leonhard with the turnip) for their Archbishop. In the Museum of Klagenfurt in the Lapidarium one can find the **Keutschacher Ruebe** (literally, turnip of Keutschach) carved out of red marble from Salzburg. (Leute *et al.* 2000).

In Tyrol and Carinthia (two Austrian provinces) turnips were chopped on a big wooden board with a large machete-like knife (**Hacklrueben**) and then put together with salt in layers in a wooden barrel (Heß-Haberlandt 1988). The fermented turnips (**Ruebenkraut**) were like sauerkraut, a very important winter food. In Carinthia on the eve of All Saints' Day turnips were hollowed out with a spoon and filled with oil and wax and with a wick to leave these turnip candles on the table overnight for the deceased members of the family (Leute *et al.* 2000). In a valley of Tyrol (Wildschönau) a brandy is still produced from fermented turnips. Also for the Austrian province Styria the cultivation and use of the turnip has been documented, e.g. since the 18th century (Schafhuber 1988).

Today, in Austria, turnips have almost no importance as staple food or fodder, but there are still some farmers growing turnips and making **Ruebenkraut** in the province of Tyrol, especially in Eastern Tyrol.



Figure 1. Fresco showing turnips in the “Cycle of the Months” in Torre Aquila in Trento (Italy). Picture provided by Castello de Buonconsiglio.

Research Methods and Materials

Ethnobotanical inventory

The study of the turnip began with the broader ethnobotanical study between 1997 and 1998 where 196 home gardens on farms from 12 communities in Eastern Tyrol were investigated (Vogl *et al.* 2004, Vogl & Vogl-Lukasser 2003, Vogl-Lukasser & Vogl 2002, 2005). In this inventory, 16 women farmers were found who grew turnip either in their gardens or as field vegetable in arable plots near their homesteads. The knowledge of these women about the turnip was recorded through semi-structured interviews. In addition to this inventory semi structured interviews were carried out with 27 elderly women about the history of agriculture in the region, including the history of the turnip. Results of the interviews with the 27 elderly women were used to describe the history of cultivation of the turnip in the study area. From this field research, seeds from 3 accessions were collected and were preserved in the gene bank of Tyrol.



Figure 2. Turnips in the coat of arms of the noble family of Keutschach. Photo provided by Dr. Gerfried Horand Leute; Lapidarium Landesmuseum Kärnten.

Semi-structured interviews

The second phase of the study was carried out between 2003 and 2004. In all thirty-three communities in the district of Lienz, the mayors of the villages or their deputies were asked to identify farmers in their villages who still grow turnips. Nineteen mayors reported no farmer with cultivation of turnips. From the remaining 14 communities 22 farmers were identified as growing turnips. There were no female farmers mentioned who were already part of the ethnobotanical inventory of the above mentioned first step of the research. The 22 farmers mentioned, were contacted by phone, informed about the aim of the study and asked for permission for an interview. Five of these farmers said that they no longer grew turnips. Eight did not want to give a detailed interview and only mentioned if they grew turnips either for subsistence (six of them) or for commercial use (two of them). With the nine remaining farmers semi-structured interviews were carried out over the telephone.

Out of these nine farmers, three farmers who grew turnips on a large scale were chosen for a semi-structured interview at their home. Questions in these interviews were open ended and the answers were tape recorded with the permission of the respondents. Tapes of the interviews were copied and each copy given to the respective respondent.

Participatory and non-participatory observation

At the homestead of one farmer who grew turnips participant and non participant observation took place over a twelve month period. The farmer was asked to inform the authors about every step in cultivation and processing of turnips. He did so and called us frequently to invite us to be present during such activities as ploughing, sowing, and harvesting. During non-participant observation, slides and digital pictures were taken, and if the character of the work permitted, the farmer was interviewed on his work. After becoming more familiar with the farmer's family, the authors asked for permission to participate during work.

Study area and people

The study area Eastern Tyrol (identical with the district of Lienz) is part of Tyrol (Austria). Nevertheless, the district has no common border with Tyrol, but with Carinthia (East and South), Salzburg (North) and Italy's province Alto Adige, also called Southern Tyrol (West) due to historical political reasons. High Mountain ranges (highest peak at 3,674 m) fence in the district to the North and to the South. Low grade roads heading to the West and to the East connect the district only to peripheral less developed Italian and Carinthian regions. The driving distance to the capital city of Tyrol (Innsbruck) is 3 hrs, and to major cities between 2 hrs (Klagenfurt) and 3 hrs (Salzburg or Bozen). The region is unique in Austria for its remoteness.

Several economic and social parameters show, that the district is one of Austria's least developed regions in terms of unemployment. No other district shows a higher percentage of people working as farmers or people working in the agricultural and forest sector. Annual precipitation in the district of Lienz (Eastern Tyrol) is 826 - 1,354 mm and mean annual temperature 2.8 - 6.9°C. Values depend on exposure and altitude. They show the range of natural conditions within a small area, leading to a highly diverse pattern (Staller 2001).

In Eastern Tyrol 2,313 farms are managed by families. In addition 445 farms are managed by associations of different legal status. The total number of farms is 2,758. 20.3% of them run the farm on a full time basis; the rest combine farming with off the farm labour. Eighty three farms are not accessible by car the entire year, while eleven farms are accessible only on foot (Brugger 2001).

The historical form of agriculture in this region can be described as mountain cereal grazing (Netting 1981), where arable farming (cereal cultivation, field vegetables, fiber crops etc.) were the main component of the subsistence system until the 1970s. Wide parts of today's meadowland were tilled up to 1,700 m above sea level. Many old mills in this mountainous area are still witnesses of this old agriculture. Some of the most beautiful old mountain mills are in Eastern Tyrol. This economy making life possible in the Austrian Alps is documented in incomparable photographs beginning in the 1930s reaching up to our time by the Tyrolean geographer Erika Hubatschek (1988, 1992).

In this ecosystem turnips have been a very important staple food over the centuries. After the harvest of cereals, turnips could be sown into the stubble-field. From this the words **Halmrüben** or **Stoppelrüben** arise, literally meaning turnips growing in a field, where you still could see some remaining straw in the corn field.

Farming systems in Eastern Tyrol have been in a process of change in the last few decades. Cultivation of cereals (e.g. *Secale cereale* L., *Triticum aestivum* L.), fiber crops (e.g. *Linum usitatissimum* L., *Cannabis sativa* L.) and field vegetables (e.g. *Pisum sativum* L., *Vicia faba* L., *B. rapa* ssp. *rapa*) has been declining during the last three decades, due to unfavourable economic circumstances and their need for high inputs of labor. The economy is dominated by meadow land in lower zones, where hay is produced for winter fodder and by pastureland in the higher alpine zones, where cattle remain throughout the summer. Nowadays the majority of mountain farms in Eastern Tyrol are based on cattle breeding, milk production and forests for financial income. Some farmers offer beds for tourists; processed milk, meat and other products from the farm. For self consumption farmers diversify their basic activities by adding operations like: keeping sheep, goats, pigs, hens and bees; growing fruit, herbs or vegetables (e.g., potatoes). Farming is combined with different kinds of off

the farm labor and federal subsidies play an important role as income (Vogl Lukasser & Vogl 2002).

Results

The focus of the former agricultural society has been the cultivation of crops that may be stored well during long winters, including the harvest of hay as fodder for animal husbandry (cattle, sheep, and goats). Now almost all farms have access to shops all year round and every household relies on facilities for freezing. As a consequence, the focus on growing plant species which demonstrate ample ability to be processed for storage through drying, fermentation, cooking etc., as well as the local knowledge on these techniques, including the knowledge to produce, store and process turnips in the traditional way has decreased remarkably. This knowledge, common in every household in former times, is known only by few experts today.

Socioeconomic importance

According to elderly farmers, until the 1970s every farmer in Eastern Tyrol had some area cultivated with turnips for subsistence at a size of about 500 - 1,000 m². These farmers did not only grow, but also process, consume and propagate turnips. This kind of subsistence-management has changed in recent decades. Today only thirty-three farmers were identified as to growing turnips. These farmers can be divided in two groups.

The first group are farmers who grow turnips for subsistence. They grow plots of turnips in gardens or on small arable plots near the homestead. In total twenty-six farmers belong to this category whereas sixteen were identified during the broader ethnobotanical research about home gardens in 1997/1998 and ten were identified during the second phase of the study 2003 - 2004. The maximum size of the plots is 500 m² whereat most of the plots do not obtain more than 100 m². The area dedicated to growing turnips for subsistence is smaller in size than in former times, because the need for turnips as staple food and fodder is no longer as high as it was in former times. Today turnips are usually eaten only once a week as fermented turnips which accompany **Tiroler Knödel** (a kind of dumpling). Turnips and fermented turnips are no longer prepared for other purposes or dishes, as described in a later section of this paper on historic uses. The historic recipes are only narrated by elderly women. All these farmers have in common, that they use between 70% and 80 % for subsistence and sell turnips or fermented turnips only in small amounts. Some of them give these small amounts of fermented or fresh turnips to neighbours or family members for free, as a gift or barter.

The second group of farmers commercialise fermented turnips. Seven farmers belong to this category. The com-

mercialisation for fermented turnip began about 20 years ago. These farmers have turnip plots covering an area between 1,500 and 5,000 m². The Average harvest ranges between 300 – 500 kg /100 m² (depending on the amount of precipitation during the vegetation period). Of the total harvest, over 80% is designated to produce fermented turnips for commercialisation. From 100 kg harvested turnips, an average of 60 kg fermented turnips can be produced. Fermented turnips are not exported from the region. Farmers sell from the farm gate, at regional markets, shops and supermarkets to local people. The price for fermented turnips ranges between €1/kg sold from the farm gate, and €0.60/kg, sold to regional supermarkets. Fermented turnips for sale in shops and supermarkets are sold in little plastic pots. For sale to consumers the sales-clerk places the requested quantity into plastic bags. Many consumers prefer to bring their own box when they buy the product. High quality fermented turnips show small cut pieces only, white colour and the appropriate acidity. Therefore, consumers of the region reject fermented turnips from other provinces like Carinthia, because of the different texture (rather long pieces), grey colour and low acidity of the fermented turnips.

Farmers comment that the market situation is a secure income because of the fact that in the region almost all farmers have abandoned turnip growing. At the same time people in the region still show a high interest in the consumption of fermented turnips. For the families who cultivate turnips in Eastern Tyrol for commercial use, the production of fermented turnips is an important source of income. They comment that production of fermented turnips is highly regarded, because the whole production cycle lies in their hands. Farmers stress that most of the necessary hand work can be done from October until end of February, where not a lot of other duties have to be done and that there is no financial investment in producing fermented turnips, as all the machinery and equipment was paid for years ago. However, it is never the main source of income and amounts about €10 – 11 for one hour of work.

The cultivar

There is probably only one local cultivar which is widespread throughout the region and cultivated by twenty one participant farmers of the survey. Four farmers buy the seeds of commercial cultivars from wholesalers or retailers. The local cultivar of turnips has been propagated (**zügeln**) by farmers in the region for several generations. The seeds of the local cultivar are not available on the seed market. Three farmers (who usually grow the local cultivar) reported trials with commercial cultivars, which were rejected again, because they did not respond to the needs.

The swollen hypocotyl and root of this local cultivar is flat, has a purple top with a white bottom and white flesh. The

size is between 10 – 20 cm wide and 5 - 10 cm long (without the long pointed end of the root). The turnip is exposed up to 3/4. Leaf shapes range from almost entire to pinnate with a length of 20 - 30 cm. The seeds are reddish brown and globular. Characteristics of this cultivar are satisfactory for farmers and therefore farmers do not engage in conscious selecting and do not grow seeds of new commercial varieties.

Although the species *B. rapa* subsp. *rapa* has a lot of local names like **Rübe**, **Herbstrübe**, **Wasserrübe**, **Soachrübe**, **Gratscharübe** and **Stoppelrübe**, the cultivar itself has no specific technical or local name. The most important agromorphological characteristics of the cultivar (Figure 3) reported by farmers are:

- flat shape, where almost 3/4 of the hypocotyl is above ground and therefore easy to harvest by hand;
- productive tuber;
- rapid tuber growth, a short season crop and therefore good yield in spite of the short vegetation period;
- fast growth and therefore suppressing weeds;
- good tolerance against diseases;
- tolerance against frost;
- red/purple top of the peel and white colour and no fibrous structure of the flesh;
- long time storage (up to 6 months);
- typical sweet taste (other varieties are hot);
- the fact that this species and its cultivation is cultural heritage, which should be maintained.

Propagation

Cultivation of turnips for the production of seeds is a biennial process, i.e. for the generative development turnips need vernalization. As a consequence the necessary steps to obtain seeds involve sophisticated local knowledge. According to elderly farmers, the farmers who grew turnips produced the seeds on their own. Production of seeds is currently carried out in the same way as in former times and the knowledge is passed on from generation to generation.

Today farmers, who grow turnips for commercialization, produce the necessary amount of seeds for their plots on their own. They grow about 40 - 80 turnips at a specially dedicated and protected multiplication plot of about 8 m² to 16 m² that yield about 1 – 1.5 litres of seeds per 40 turnips (Figure 4). The group of farmers who grow turnips only for subsistence, 31% obtain seeds as a kind of typical exchange between neighbours and friends, and 46% grow 2 - 5 plants in their home garden for the production of seeds. 8% buy the seeds in a monastery in Lienz, where seeds from the local cultivar are produced. 15% get the seeds from the wholesaler and do not grow the local cultivar.

Turnips that are grown to produce seeds need to be stored during winter and need to be protected from deep frost and dehydration. Storage is done in



Figure 3: The local cultivar of turnip.



Figure 4. Covering the turnip seed nursery (**Assling**) with a net to protect it against birds.

- pits (**Mieten**) in the garden (only for turnips that shall produce seeds exclusively);
- cellars
- wooden tubes (**Stiebich**) (only for turnips that shall produce seeds exclusively);
- in plastic bags (only for turnips that shall produce seeds exclusively);
- on bare soil (**Erdkeller**; for turnips that shall be used as fodder, but some of them should also produce seeds);
- or turnips left at random in the plots.

Pits are places where turnips are put with the head up in a hole in the earth (ca. 100 cm deep) and covered with straw and soil. Attention must be paid that the selected location has dry soil. The heaps have to be made before soil becomes frozen. During winter the pit is not opened, therefore this kind of storage is used only for turnips that shall produce seeds. If pits are used, a few appropriate turnips are selected during the harvest or processing in autumn. Criteria to select the most appropriate turnips for propagation are colour and shape, the size (not too large and not too small), hardness and absence of pests and

diseases. One to two centimetres of the leaves are left and some centimetres of the roots are cut before the turnips are put into the pit. The selections for turnips which are stored in wooden tubes or plastic bags show the same timing and selection criteria. The tubes are stored in cellars which is not essential because the turnips are covered with moist linen. Storage in cellars needs to be cold (not more than +5°C) and dark conditions.

Cellars with bare soil or stone are said to be ideal, high relative humidity, but also excessively dry air is crucial. For storage, turnips are piled on the bare soil without damaging the heart of the turnips. Piles may not be too high to prevent warming at the centre and to make controlling easy. Both turnips for propagation and turnips used as ordinary fodder or for further processing are not separately stored over winter. Damaged turnips are selected constantly and used as fodder or composted. The selection of turnips, which later should be grown to produce seeds, is done in cellars in late winter or early spring, when only few turnips remain. Thus turnips with good storage ability are selected, an important factor for crop improvement.

After storage, turnips selected for propagation are planted between the end of March and beginning of April. In the valley of Lienz they are cultivated only in home gardens, which are situated near the homestead, to guard the valuable seed stalks. In the mountainous areas they are more often planted in the arable plots because these plots are close to the homestead.

At least 3/4 of the turnip has to be below ground after planting (inverse proportion to the turnips at harvest time). Planting distance between turnips should be about 50 cm. Branched flowering stems grow up to an altitude of 1 m. To avoid cracking they are supported by fences around the whole plot and in addition by cut branches of *Fraxinus excelsior* L. or of other branches from local trees for every second or third turnip. If grown in gardens, they are grown close to the fence and fixed with a rope to it. Also the protection from birds and deer by fences and nets is very important (Figure 4).

The seed stalks of the selected turnips are harvested between middle and end of July. Correct timing of the harvest is essential because siliques mature from the bottom to the top and mature siliques spread their seeds immediately after being touched. Therefore daily inspection and careful collecting is said to be necessary in order to minimize seed loss. Harvest starts after the first siliques ripened where colour turns from green into yellow. Seeds have to be reddish brown. Yet the whole material is not fully mature, but it is ready for harvest. Therefore, the branches or the stalks are cut with knives or scissors and put as sheaves on large linen. This linen is tied up into a bundle and cable-mounted stored at the farm in a shadowy and windy place, where the final maturation occurs. After a few days natural desiccation starts, and mature siliques open. The seeds accumulate in the linen.

The bundle is threshed by hand (**geplescht**), so that siliques, which are still closed, can be opened afterwards by rubbing them between one's hands (**ausgerippelt**). Seeds are passed through a sieve and separated from dust and broken parts by the influence of wind. Seeds are neither treated with pesticides nor in hot water. The fully dry seeds are stored in glasses with a screw on cap in a dark and cool place.

There exists no external or additional seed supply system for the local variety. Farmers do have ways of assurance in case that the selected turnips for propagation are hampered by rats, mice or other damage. They leave turnips at random at the plot and these turnips can survive winters with adequate snow cover to sprout again in spring, flower and produce seeds. This means to propagate seeds is not the usual way, because it is too dependent on the weather. Indeed one woman farmer tried to cover the turnips, which she left on the plot in the garden, with a fleece during winter and reached good results with this method. Another way of assurance is the production of a higher

amount of seeds, as is needed for a year of production. According to the informants, seeds can be stored for 3 to 4 years without the reduction of the germination level. A network of seed exchange under farmers, the contact with gene banks and NGOs that deal with storage of seeds could not be observed.

Cultivation and management

Turnips, as a cool season crop (Undersander *et al.* 1991), are traditionally sown in Eastern Tyrol into the stubbles after harvest of winter rye (*S. cereale*) or winter barley (*Hordeum vulgare* L.). Although in the valley of Lienz cereals are still grown, turnips are no longer sown in the stubble-fields as intercrop. The reason is that winter rye is harvested 3 weeks later than in former times, because today cereals are harvested with machines when they are complete ripe whereas formerly harvesting by hand was done when the seeds were not fully ripe and then put on special racks called Harpfen for final maturation and for drying. Preceding crops in the valley of Lienz are nowadays early potatoes.

In mountainous areas cultivation of cereals has been abandoned since the 1970s. One farmer started with a new sequence of crops. Preceding crops are green manure of *Vicia sativa* L. and *Avena sativa* L. This green manure is used as albuminous fodder for milkers, and is mown when it is still very young (early July). Then the plot is ploughed and prepared for the sowing of turnips. With this management, the turnips are grown on the same site over 20 years without problems.

For turnips the appropriate timing of sowing is essential. Sowing can be started earliest in Mid-July and latest Mid-August (depending on the altitude above sea level). Sowing done too early leads to woody fibrous and bitter turnips. Late sowing reduces the yield because there is not enough time for growth before the frosty period starts. To reach adequate yields, turnips need about 60 days before harvest starts. In an altitude of 1300 m above sea level, one week of delay of sowing in July means 3 weeks of delay for harvest in autumn.

As in former times, the plots are ploughed shortly before sowing (Figure 5). Soil is fertilized with manure or slurry afterwards and then the soil is dragged. To improve the quality and yields of turnips, soil with supply of water and nutrients is essential. Farmers do report bad growth on permeable sandy and dry soils. Before seeding by hand starts, seeds are mixed with sand (20 litre sand and ¼ litre of seeds) to allow equal sowing at the necessary low sowing rates. For a plot of 100 m² about 30 ml seeds are used. After sowing, soil is dragged again (Figure 6) as a means to equalize the sowing rate, to control weeds and to cover seeds with soil.



Figure 5. Sowing turnips (**Assling**).

Sowing is done in different phases to allow harvest, and therefore distribution of labour, for harvest over a longer period of time. Sowing should be done prior to a rainy period and never on a sunny day during noon. Therefore, in the sowing period farmers carefully observe weather conditions. In early stages of the crop precipitation is essential to ensure the establishment of the crop and later for good yields. If the crop develops well, no further work is done. If a lack of rain inhibits germination, plots have to be sown again. Irrigation is not done, but discussed as to be very useful and necessary to be done at those sites where it would be possible (availability of cheap water and irrigation facilities).

Plant density should not be too high (<math><15\text{ plants/m}^2</math>), and farmers say that there should be enough place for the turnips to grow large like a plate. In former times those turnips that germinated too densely and also weeds had to be pulled out by hand (**Ruibn kratschn**) and were used as fodder. Today this is not done any more. The farmer who uses green manure as a preceding crop reports henceforth fewer problems with weeds. He says that green manure is a good means to reduce the pressure



Figure 6. Dragging of sown turnips. The tool is fixed to a rope and the rope is pulled by a winch (**Assling**).



Figure 7. Harvest of turnips in Assling.

of weeds and it provides nutrients that allow turnips to establish a fast soil cover with its leaves. Once the turnip crop is established, weeds are not a problem any more. Therefore, no weed control is practiced. This farmer reports also no diseases nor pests (because of the rotation with green manure). Due to the absence of agricultural plots with commercial crops like rapeseed or other Brassicaceae species in higher regions, the pressure of pests and diseases from outside the turnip field is low.

In the valley of Lienz, where the turnip is sown after early potatoes, problems with weeds occur and weed control is necessary. It is carried out with herbicides there. Also problems with pests (e.g. *Meligethes aeneus* F.) and diseases (e.g. *Phytophthora infestans* (Mont.) de Bary) have been reported.

Harvest and processing

Harvest (Figure 7) starts beginning of October. At this time the average diameter of a turnip is between 15 and 20 cm. Harvest starts with the part of the plot, sown first. Harvest is done by hand as in former times. Turnips are pulled

out and handled very carefully to avoid rot and damage during the storage. The local cultivar, which has only one third of its root below the surface, can be pulled out easier than other cultivars, which have a longer part of the root below the ground. Leaves are separated from the root (**gratschen, gratscha**) and left at the plot. Turnips are put in wooden boxes (0.045 m³) and brought to the farmhouse. One person harvests around 50 boxes per day (2.25 m³). The leaves used to be also brought to the farmstead because they were used as fodder for different animals. Usually harvest is finished around All Saints' Day. Although turnips are frost tolerant, harvest must be finished before the first strong frost days because the leaves are ruined and therefore harvesting by hand is very uncomfortable. Also the taste suffers. For storage the turnips may not be washed.

The washing and cleaning of the turnips is done only shortly before processing. For processing farmers use rooms at the farm close to the storage facility. Turnips are washed either by hand or in an automatic washing machine with water. They are always selected by hand (to root out damaged, unsound ones, etc.) and simultaneous-

Table 1. Narrated and actual uses of turnips in the study area Eastern Tyrol, Austria

| Uses | Parts used, related recipe or tale | narrated use | actual use |
|-------------------|---|--------------|------------|
| Human consumption | Turnips eaten fresh and raw | X | X |
| | Turnips boiled, mixed with horse radish in a large vessel, left for 1 week and then eaten | X | |
| | Young turnip leaves eaten as salad with oil, salt, pepper and vinegar | X | |
| | Young turnip leaves boiled with salt and eaten as spinach | X | |
| | Fermented turnips eaten as side dish | X | X |
| | Fermented turnips boiled and prepared as a soup | X | |
| | Fermented turnips washed, cooked with flower and ham, served with hot butter and eaten as main dish | X | |
| | Fermented turnips filled in a local kind of dumplings | X | |
| | Fermented turnips filled with <i>Mentha</i> sp. in sausages | X | |
| | Fermented turnips put on the top of Zörra (a local cookie) | X | |
| | Liquid from fermented turnips used as vinegar | X | X |
| | Liquid from fermented turnips as a beverage | X | X |
| | Liquid of turnips cooked with honey as long as becoming a sirup. Use of this sirup together with local dishes | X | |
| Fodder | Various recipes for hens and pigs | X | |
| | Leaves for cows | X | |
| | Turnip for cows as milk starter | X | X |
| Medicine | Liquid of fermented turnips or fermented turnips i) as anti-inflammatory or antipyretic remedy for external application or ii) for internal application as cathartic or diuretic remedy | X | |
| | Sirup of liquid of turnips with honey against cough | X | |
| Material culture | Liquid from fermented turnips as washing-up liquid | X | |

ly separated from the rest of leaves and roots with knives. The separation of the leaves has to be done with some centimetres of the hypocotyl because this is essential for good quality of fermented turnips. The prepared turnips are cut in a special cutter and put in sterilized plastic barrels. No salt or other condiment is added. As turnips are wet, water accumulates in these barrels too. It is left there as much as the small pieces are still covered with some water. According to the respondents this is very important. The barrels are closed with a special lid and have to be stored in cold cellars so that the fermentation does not occur too rapidly. After about three to five weeks, depending on the temperature of the room where the barrels are kept, they get the appropriate acidity and the small turnip pieces show a white and glassy colour. Careful attention must be paid to work under hygienic circumstances, which was stressed by all informants. As in former times, the principles of the processing turnips for making fermented turnips have not changed. However, work of some steps of production (washing and cutting) has been replaced by machines.

Uses and cultural context

The most frequently mentioned use was the use of fermented turnips in human consumption as a side dish (salad) accompanying **Tyrolean Knoedel**, or **Schlipfkrapfen**. This side dish is served usually once to twice a week. All informants who knew turnips mentioned this use as a main use and currently use it this way.

Additional uses were reported mainly by the elderly informants. All parts of the plant were used for human consumption. From December to April almost every day fermented turnip was eaten as a side dish, but also converted into various kinds of main dishes (Table 1). Bulbs and leaves were cooked as a kind of vegetable in several dishes. Leaves sprouting in winter in the cellars were eaten as salad. In former times, the variation of preparing and using this vegetable in human consumption was much higher than today. In literature turnips from *B. rapa* are also frequently mentioned in cookbooks and historically contemplations of foodstuff in the countryside can be dated from 1600 up to 1900 (Maier-Bruck 1981).

Although reports show that people know that *B. rapa* ssp. *rapa* can have different uses, the only other actual exercised use apart from using fermented turnips in human consumption, is to feed the severe turnips to cows (as a kind of milk-starter) in late autumn and winter. Fodder, not only for cows but also for pigs, hens, sheep and goats was another important use in former times. For this purpose not only the turnip, but also the leaves and fermented turnips were used. For some of the livestock special dishes were prepared, e.g. **Hennpfarfilan**. Turnips and products of turnips played an important role in the traditional medicine and were used for various purposes (Table 1). One elderly person mentioned that the water of fermented turnips was also used as a polishing material. Most of the uses, the related recipes and cultural context are only known by the elder generation.

Culturally important was that processing of turnips was a joint venture with members of the family of different ages but also neighbours participated in late falls. During these working periods folktales and traditional beliefs were narrated and passed on. Traditions like **Kraut bloosn**, where unsuspecting people passing by were asked to blow into the barrel with hand chopped turnips and then as a practical joke, their head was pushed into the turnips. Or **Krautreiro trogen** where neighbours brought something to drink (a wine or a liquor) when people outdoors chopped the turnips were practiced. This once collective work has since turned into individual work. These traditions are no longer practiced and the tales and beliefs are only known and narrated by the elder generation (older than 60 years).

Concluding remarks

The turnip (*B. rapa* ssp. *rapa*) was one of the most important crops grown over the centuries in Alpine regions. In the study area every farmer grew turnips. For the elderly generation turnips were in high reputation as an every day vegetable and versatile utilized species with basic foodstuff character. Today only thirty three farmers (a total of 2,758) in the study area were identified as growing turnips. In spite of the decrease of cultivation of turnips, consumption of fermented turnip is still widespread throughout the region. Nevertheless "the turnip culture" is in danger of disappearing. The accessions of local cultivars are only propagated by a few farmers. The associated knowledge of propagation, but also the way to cultivate harvest and process turnips is known by only a few local farmers who grow turnips for commercialization. The survival of the cultivation of turnip by a few farmers is closely related to the high local appreciation of the specific taste for fermented turnips whereas the various uses and different stories belonging to the cultural context of the turnip are in danger to disappear from the region. To preserve *B.*

rapa and the associated knowledge from distinction different steps must be undertaken in the future: These include ex-situ and in-situ conservation, complemented by activities to ensure continuous demand by consumers.

Next steps in scientific research about turnips, which we would like to encourage as one means to recognize turnips and revive turnip culture could be agronomic and genetic analyses of the different accessions from the region to assess the distribution of diversity within and between the populations. To assess the distribution of diversity within the different accessions and to assess if that variety is the only genotype in the area, which can be regarded as a local cultivar, morphological and use traits still have to be carried out. Also a test for distinctness versus accessions or cultivars from Southern Tyrol/Alto Adige and Carinthia as well with cultivars from the EEC Common Catalogue has never been undertaken and would be an important project for the future. It is also possible that further accessions can still be found within Eastern Tyrol. In the gene bank in Northern Tyrol some accessions from Außervillgraten (Eastern Tyrol, Austria) are maintained. But all genotypes available would have to be tested for morphological and genetic relationship.

Studies on the ethnopharmacology of turnips; studies of the cultural context including songs, jokes, stories and recipes on turnip; testing of hypotheses, like that turnips grown at higher altitudes produce higher quality fermented turnips, that every valley counts with its specific regional cultivar, or that addiction to the specific taste of fermented turnips of certain Consumers is a reason that demand is still existing.

We do encourage colleagues to support the biocultural heritage of turnips by scientific research.

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