



Final hop report - crop 2022

1. The situation during the crop year and the quality

A) Development of the weather and the situation in production 2022

The Tables 1 and 2 indicate summarized data of temperatures and precipitation during the whole vegetation period (April–August) in 2022, compared to the same period of 2021 and to the 30 years' long-term average (1981–2010).

Table 1 – Temperature (°C)

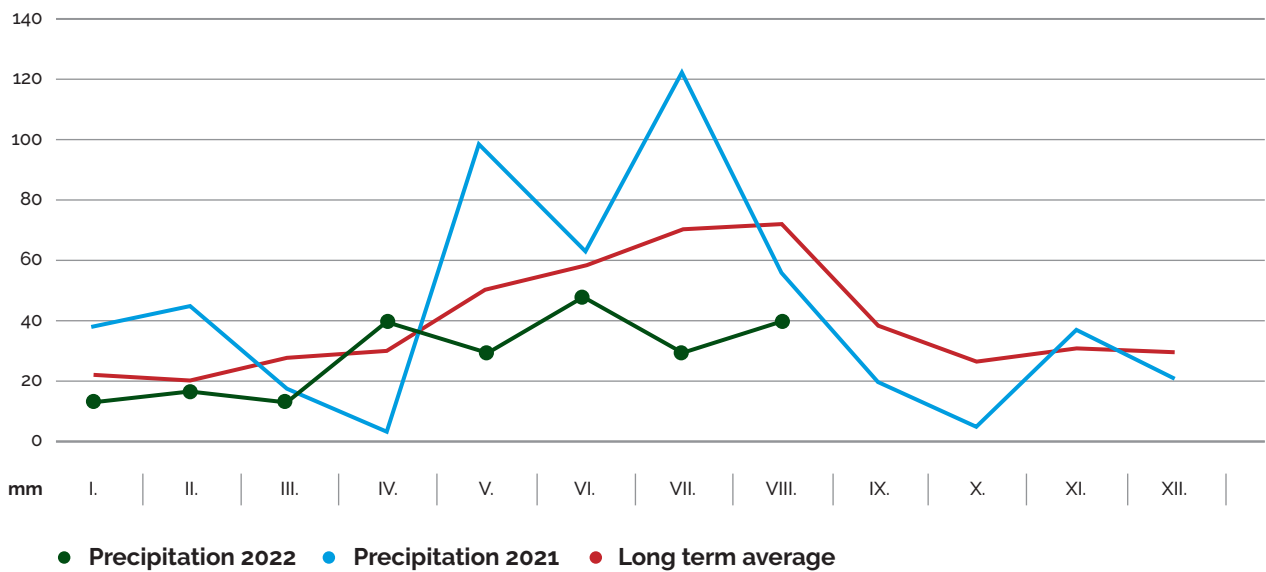
Month	Average temperature		Difference +-	30-years average	Difference +-
	2022	2021			
April	7,40	7,17	+ 0,23	9,10	- 1,70
May	15,40	12,13	+ 3,27	14,20	+ 1,20
June	19,90	20,30	- 0,40	17,00	+ 2,90
July	19,80	19,95	- 0,15	19,00	+ 0,80
August	19,80	17,47	+ 2,33	18,30	+ 1,50
Total	82,30	77,02	+ 5,28	77,60	+ 4,70

Table 2 – Precipitations (mm)

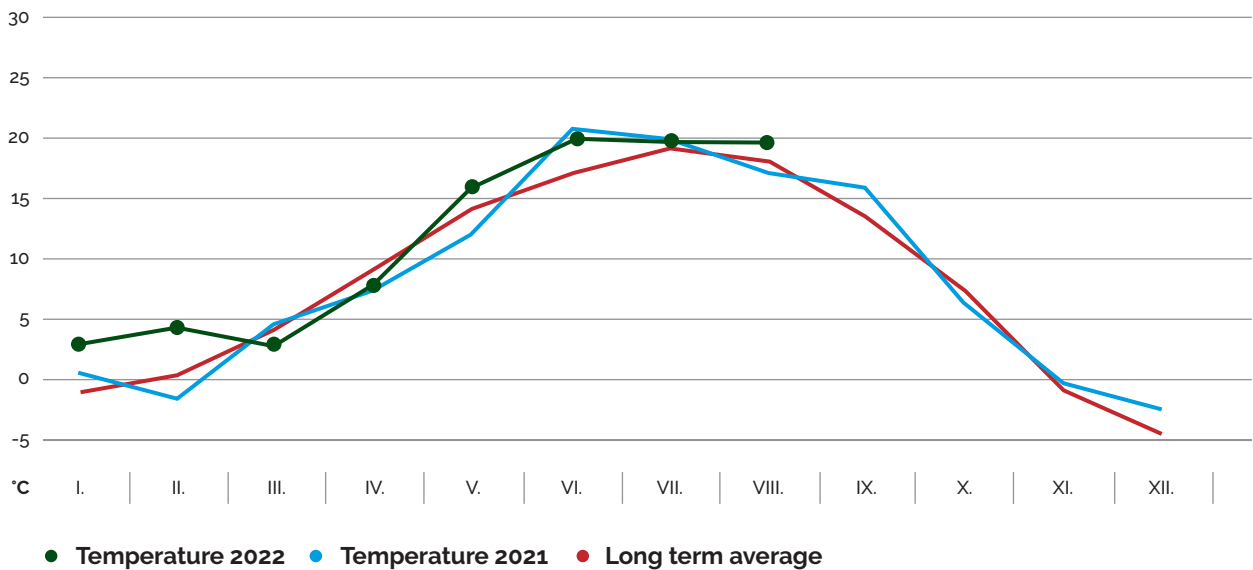
Month	Total precipitations		Difference +-	30-years average	Difference +-
	2022	2021			
April	39,80	6,80	+ 33,00	30,70	+ 9,10
May	29,80	97,40	- 67,60	52,00	- 22,20
June	47,00	64,60	- 17,60	59,10	- 17,60
July	27,70	123,20	- 95,50	69,40	- 41,70
August	40,50	56,60	- 16,10	70,80	- 30,30
Total	184,80	348,60	- 163,80	282,00	- 97,20

The data indicated above are accompanied by graphs illustrating the average temperatures and the total of the precipitation per month, covering period of January–August, 2021 and January–August, 2022. (Graphs 1 and 2)

Graph 1 – Precipitation in 2022 and 2021 compared to a long average



Graph 2 – Temperature in 2022 and 2021 compared to a long average



The weather in the first trimester of 2022 was characterized by higher average month temperatures in January and February, in comparison to the previous year as well as to the long term average. Paradoxically, the average temperature in March was lower than in February and it approximated to the level of January. This situation was caused by very low temperatures during the first half of the month - e.g., on March 13 the minimum temperature dropped to $-10\text{ }^{\circ}\text{C}$. Precipitation during the first trimester 2022 were below the level of the long-term average as well as below the level of 2021. It concerned all three months of the first trimester.

This year's April was below average in temperature, similarly to previous year. Also the maximum and minimum temperatures were recorded on the same level as of April, 2021. The feeling of the temperature was decreased by the cold wind, which also significantly drained the soil. In terms of precipitation we consider this April as slightly above-average. The total sum of the precipitation was considerably influenced by rain on April 24, 2022, when 17 mm of the water have fallen.

The average temperature in May 2022 was above normal, although the minimum temperatures in the first decade of the month were relatively low. The temperatures in some localities even decreased below freezing point. The difference of the average temperature in May 2022 compared to the long-term average was $+1,2\text{ }^{\circ}\text{C}$ and compared to May 2021 then $+3,27\text{ }^{\circ}\text{C}$. Maximum temperatures than ranged between $20\text{ }^{\circ}\text{C}$ and $25\text{ }^{\circ}\text{C}$. The temperature recorded on May 20, 2022, i.e. $30,1\text{ }^{\circ}\text{C}$, was simply an exception. The precipitation in May 2022 were very bad compared to last year and reached only 30,6 % of the rainfalls of previous year. Compared to the long-term average it reached 57,3 %. Water regime of this year we consider very bad.

Very dry weather prevailed throughout the period of the first two decades of June 2022. It was not until the end of the month that in some places there appeared heavy rainfalls of stormy character. In some locations (Zlonice, Šlapanice, Senice na Hané) the hop gardens were damaged by hailstorms. Some municipalities in the Auscha region

(Radovesice, Vojkovice, and Dušníky) were affected by rains which brought over 100 mm of the precipitation during three days and the soil there became heavily soaked. The temperatures during the first two decades of the month were at the normal level, then in the third decade there came a significant warming and the daily temperatures exceeded $30\text{ }^{\circ}\text{C}$. This warming had a negative effect on the development of hops.

The development of climatic conditions in July 2022 was very unfavourable for hops. The average monthly temperature exceeded significantly the long-term average thanks to very high maximum temperature levels during the third decade of the month. The maximum daily temperatures increased above $30\text{ }^{\circ}\text{C}$ every day between July 19, 2022 and July 26, 2022. The amount of precipitation in the Saaz region was very low, in July 2022 it reached only 39,91 % of long-term average.

In August 2022 the rains came at the beginning of the third decade. The rains at the end of the month were predominantly of the stormy character and so they were different in different locations. E.g. the precipitations in Žatec (Saaz) were 19 mm, but in Kozlovice (Ústěk - Auscha region) they reached 80 mm at the same day. The rains caused worries to growers during the harvest. The average monthly temperature in August was $19,8\text{ }^{\circ}\text{C}$ and so it exceeded the long-term average by $1,5\text{ }^{\circ}\text{C}$

B) Quality: alpha contents in original, aroma, the appearance of the cones, the pests

The nature of the weather enabled the growers to carry out spring works in hop gardens at the usual time. Weather without precipitation then allowed the growers to cut hops as usual. The pruning of hops was smoothly followed by the stringing of training wires and their embedding. Works on hop gardens were predominantly carried by the foreign workers. However, cold weather negatively affected the growth of hops. The hop plants practically did not grow due to very low temperatures. The time difference in hops pruning has therefore disappeared and it was assumed that the hops would grow all at once, independently of the date of the cut. The demand on the number of temporary workers therefore increased. According to the state of vegetation the beginning of the training of hops was then estimated between May 6 and May 10, 2022.

Colder weather during the first week of May has influenced negatively the growth of hops. Due to the fact that hops grew very slowly at the beginning of May, the growers had to wait to the beginning of the training of the hops. The situation changed with the warming on May 6, 2022, when the hops started to grow intensively and the training could start on the same day. Thanks to the sufficient number of the temporary workers the training was successful and finished by the end of May. At the end of the month the hops were taller than average on majority of hop gardens and was four to five days ahead the normal development.

The growth and development of hops was very good until the end of the second decade of June. High temperatures on June 19 and June 20, which ranged from 37 °C to 39 °C slowed down the stretching growth of plants. On some hop gardens the stretching growth completely stopped. For this reason part of the hops will not reach the height of the trellis. Given the current climatic conditions, especially high temperatures, we did not expect a significant continuation of the stretching growth. The hops started to flower at the beginning of the third decade. At the end of month the cones of hops

could already be seen on some of the hop plants where early pruning had been done.

The phase of the elongation growth of Saaz hops was practically zero in July 2022. The elongation growth persisted only in hybrid varieties. The habitus of the plants was weaker in this year, on some hop gardens the plants were pointed and did not reach the height of the trellis. Following the given development of hops, the hops started to flower very early this year, as we already announced in the vegetation report for June. Flowering was relatively weak. Most of the hop gardens were already in the stage of cones creation. Based on the current state of hops at that time a below-average harvest could be assumed.

The condition of hops in terms of habit did not improve since previous month and it remained weak. The deployment of flowers, influenced by high temperatures, was very bad – part of the flowers did not even develop. The harvest started by individual growers in the time horizon from August 13, 2022, to August 25, 2022. Majority of the growers decided to start the harvest between August 19, 2022, and August 21, 2022. Based on the assessment of the state of the hops the harvest is expected deeply below average. The first results of the laboratory tests of the content of alpha acids in Saaz hops show also below-average values. Concerning hybrid varieties, we still do not have sufficient data for a reliable assessment, but according to the state of growth we expect that the decrease of the alpha bitter compounds should not be so expressive like in case of Saaz hops variety.

C) Chemical protection of the hops

Due to the spring climatic conditions some of the hop gardens were treated only against alfalfa snout weevil (*Otiorrhynchus ligustri L.*), which appeared in spite of the cold weather. The spraying was applied by the preparation Actara 25 WG, permitted by the Regulation of the Central Institute for Supervising and Testing in Agriculture (ÚKZÚZ) for limited and controlled use. At the same time on the earlier pruned hop gardens there was monitored the devouring of the leaves by the flea beetle (*Psylliodes attenuata K.*), causing damages on the spring vegetation. Protective intervention was recommended on these areas.

Taking into account the weather in May it was recommended to carry out the protective intervention against downy mildew of hops (*Pseudoperonospora humuli Miy et Takah.*) by the preparation Aliette 80 WG immediately after the training of the hops. In this year very strong spring incidence of the hop aphid (*Phorodon humuli Schrank*) was noticed on the host plants. Therefore, it was recommended to do thorough monitoring and - where the critical number was reached - to carry out the treatment with the preparations Teppeki, Afinto, and/or Sivanto Prime. Warm weather during the second half of May speeded up the population dynamics of the red spider mite (*Tetranychus urticae Koch*). That is why also in this case the thorough monitoring was recommended and where the critical number was reached (5 spider mite individuals on the leave of the lower floors) to carry out the treatment by the preparation Nissorun 10 WP. In the hop garden areas, where the occurrence of the alfalfa snout weevil or the spring population of flea beetle were found out, the preparation Actara 25 WG was applied.

Following measures to protect hops were applied in June 2022

Downy mildew of hops – within June 21, 2022 and June 30, 2022 the first treatment against the secondary infection was carried out. The preparations Bellis, Ortego and/or Ortiva were applied. In the hop gardens with the occurrence of the spike sprouts it was recommended to treat the hops with the curative fungicide Carial Flex.

Hop aphid – due to sooner occurrence of the hop aphid in this year the hop aphid was eliminated earlier. With respect to the hops development it was recommended to use the preparation Movento 100 SC at the turn of June and July, so that the active substance is sufficiently distributed through the conductive tissues.

Red spider mite - warm and dry weather during the second half of the month was optimal for the development of the red spider mite. Thorough monitoring was carried out and where the critical number was reached (5 individuals on the leave) the hops was treated by the preparation Nissorun 10 WP, or possibly by the preparation Ortus 5SC. Towards the end of the month the preparation Movento 100 SC was used – the same rules are valid as for the use against the hop aphid.

As stated above, the preparation Movento 100 SC was applied already at the turn of June and July 2022. By this way the protection of hops against hop aphid was solved. Due to the optimal climatic conditions for the propagation of the red spider mite it was necessary to pay an increased attention to that pest. For further use the preparations Ortus 5SC and Vertimex 1.8 EC were available. More wet weather at the beginning of July was optimal for the propagation of downy mildew of hops. Therefore, the treatment of hops by the preparations Bellis, Orvego or Ortiva was carried out.

Health state of hops was good also in August, 2022. Most serious problem for the growers was to keep good health state of hops owing to the occurrence of the red spider mite.

Following Table demonstrates the contents of alpha-bitter substances in hops according to individual regions and varieties, as analysed in the laboratory of Chmelařství, cooperative Žatec.

Table 3 – Alpha-acid content in original material according to varieties and regions (in %)

Region	Saaz	Sládek	Premiant	Kazbek	Saaz Late	Agnus
Saaz	2,89	6,67	8,45	-	-	-
Auscha	2,80	6,61	7,84	-	-	-
Trschitz	2,71	4,51	7,38	-	-	-
Czech Rep.	2,80	5,94	7,95	-	-	-

The above mentioned alpha content is corresponding to values in the laboratories of CHMELARSTVI. The estimated average alpha contents for individual varieties from all the laboratories for the Czech Republic for crop 2022 in total are following: Saaz - 2,8 %, Sladek - 6,0 %, Premiant - 7,8 %, Kazbek - 5,9 %, Saaz Late - 2,8 %, Agnus - 11,8 %.

D) Estimation of acreage and yields according to regions:

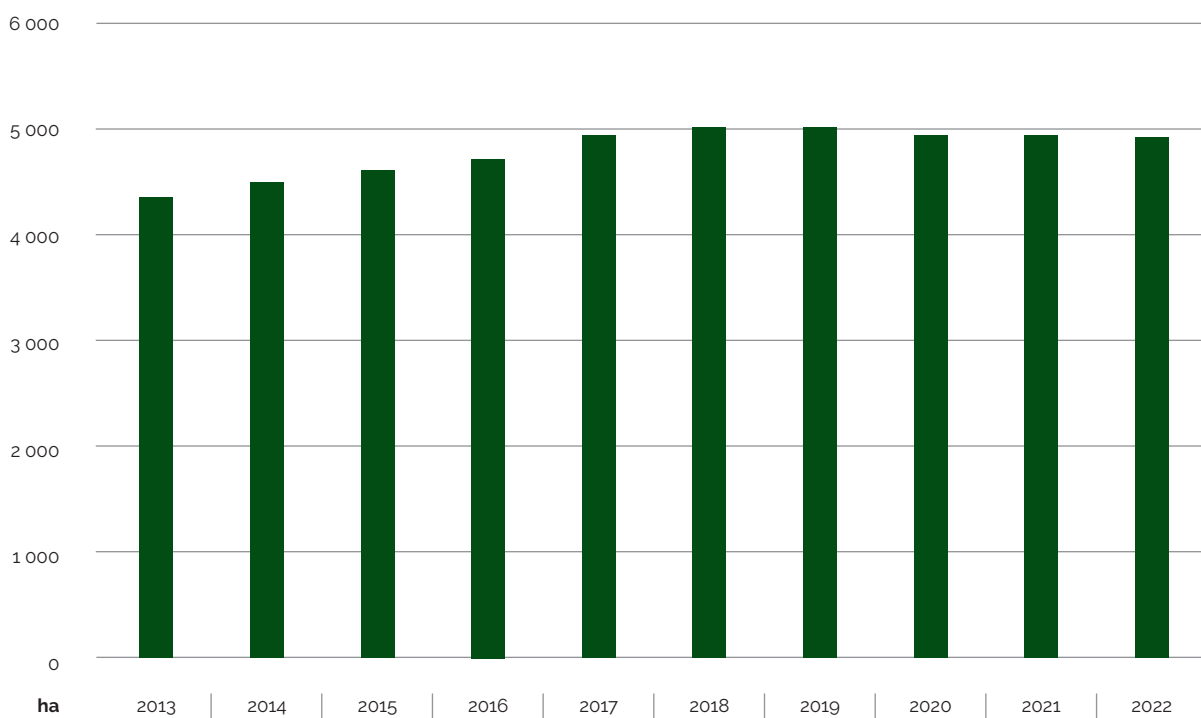
The harvested acreage slightly decreased in comparison to 2021, more precisely by 28,6 ha. The acreage of Saaz hops variety then decreased by 48 ha. For the crop 2022 the harvested areas are shown in following Table. The data indicated were kindly conceded by the Central Institute for Supervising and Testing in Agriculture in Žatec (data up to August 20, 2022 – comparison to August 20, 2021).

Table 4 – The acreage of hop gardens in the Czech Republic (ha)

Region	up to 20. 8. 2022	up to 20. 8. 2021
Saaz	3800,7	3833,8
of it Saaz variety	3244,0	3299,8
Auscha	520,4	516,9
of it Saaz variety	413,0	410,4
Trschitz	621,4	620,6
of it Saaz variety	478,6	473,5
Czech Rep.	4942,6	4971,2
of it Saaz variety	4135,6	4183,6

The trend of the increase of acreage of hop gardens practically stopped. The total area stabilized at around 5000 ha, although the decrease year-on-year was recorded. In order to illustrate the development of the acreage of hop gardens in the Czech Republic during previous ten years we enclose the graph covering the period of 2012–2022.

Graph 3 – The development of the acreage of hop gardens in the Czech Republic



It is again very complicated to make the accurate estimates of the production of hops in the Czech Republic in this year, due to differentness of the beginning of the harvest by individual growers, the overall condition of hops in relation to the bad climatic conditions and big differences in the yield per hectare by individual growers as well as in individual hop gardens. The exact results will be known after the summarization of individual "Producers declaration about the number and the weight of marked packing with hops according to the cadastral territories and varieties of hops", made by the Central Institute for Supervising and Testing in Agriculture in Žatec, i.e. during the second week of December.

Table No. 5 – Estimation of the crop 2022 according to regions (total)

Region	Harvested area (ha)	Production (t)	Yield in t per ha
Saaz	3800,7	3110	0,81
of it Saaz variety	3244,0	2220	0,68
Auscha	520,4	500	0,96
of it Saaz variety	413,0	330	0,80
Trschitz	621,4	690	1,11
of it Saaz variety	478,6	450	0,94
Czech Rep.	4942,6	4300	0,87
of it Saaz variety	4135,6	3000	0,73

2. Forecast of the production in the future (2022–2023)

A) Expected replacement of the varieties and hypothetical production of individual varieties

Table 6 – Comparison as per the variety composition in 2022–2021

Variety	2022 ha	2021 ha	Difference ha 21/21
Saaz	4135,6	4 184	- 48,4
Agnus	70,5	60	+ 10,5
Kazbek	22,2	22	+ 0,2
Premiant	212,8	217	+ 4,21
Sládek	397,4	374	+ 23,4
Saaz late	32,1	44	- 11,9
Saaz special	41,2	41	+ 0,2
Others	30,8	29	+ 1,8
Czech Republic	4942,6	4 971	- 28,4

B) Expectation of the planting of new varieties and the yields:

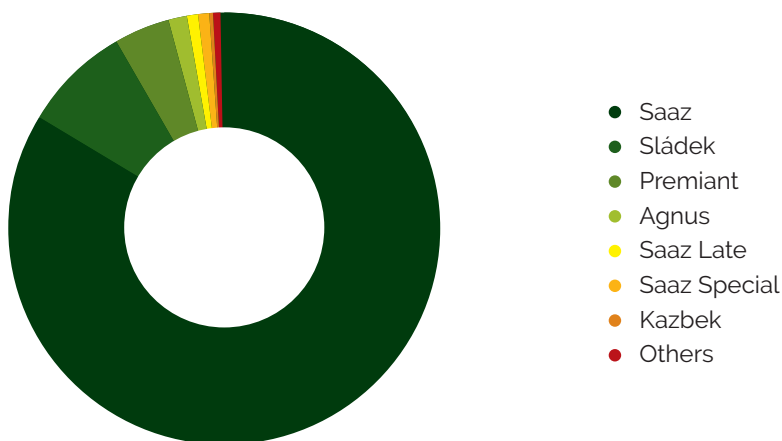
It can be stated that the trend in the renewal of hop gardens and planting has slowed down. According to the information from the seedling producers, higher interest in hybrid varieties, especially in Sládek var., was recorded among the growers of hops. The quantity of the ordered seedlings represents an area of approximately 170 ha. However, it will mostly concern the renewal of hop gardens, especially in case of the Saaz hops.

C) Expected production areas

Table 7 – Composition of individual varieties on harvested area in 2022–2021 (ha)

Variety	area 2022	%	area 2021	%
Saaz	4135,6	83,67	4 183,6	84,16
Agnus	70,5	1,43	60,4	1,21
Kazbek	22,2	0,45	22,2	0,45
Premiant	212,8	4,31	216,9	4,36
Sládek	397,4	8,04	373,8	7,52
Saaz Late	32,1	0,65	44,1	0,89
Saaz Special	41,2	0,83	41,4	0,83
Others	30,8	0,62	28,8	0,58
Czech Republic	4942,6	100,00	4971,2	100,00

Graph 4 – Composition of individual varieties on harvested area in 2022



3. Trends on hop market

The unfavourable climatic conditions of 2022 impacted especially the Saaz variety where the crop is extremely low. It will be necessary to open communication with all customers about reductions of contract volumes and replacement of these volume from future crops. The previous crops are sold out but many brewers used the very good crop of last year for extra purchases of hops with very good alpha acid and advantageous pricing. We hope that brewers will be able thanks to this purchases overcome the hard volume situation of the 2022 crop.

Other Czech varieties produced also under average yields. Contract volume reductions will need to be discussed also here but we expect that this will be slightly lower reductions compared to Saaz variety.

As to following year the volumes will need to be mainly used as a replacement of the 2022 missing volumes to replenish the brewers stocks to satisfactory level.

It will be also necessary at the same time to include discussion about the rapid growth of costs of growing.

Due to the given situation of this year, when the costs of production have increased enormously (fertilizers, pesticides, energy, gas, wire, etc.) and at the same time due to unfavourable weather conditions, which caused "record-breaking" low crop, there is a risk of sharp decline of the hop area in the coming years.

This situation requires a quick solution since for Czech hop growers there is an extremely large gap between their costs which increased by around 25-30 % and the low income due to the yields which are below 60 % of the long-term average. Per hectare, this is min. 3000 EUR in costs increase and in the income this means 5000-6000 EUR less. The loss per hectare can therefore reach 8000 EUR for the growers and this is very serious.

We therefore need to seek assistance for growers both from national programmes but the unexpected cost increase due to current situation shall also be reflected in the pricing. A discussion is needed about the conditions of the contracts. This is necessary to provide enough financing for the growers to continue with hop growing and also with the investments without acreage reductions.

4. Quality control

The change of technology and packing material for the crop 2022

Before the 2022 season many maintenance operations took place in the whole storage and processing lines. Large projects were done in terms of floors in the main pellet processing hall and surrounding storage areas. The tall storage building got new roof system and many smaller repair and maintenance were done in all parts of the main line. Following the new IHGC code introduction on labels a software adjustment was necessary also for the main Hopwin software which is running all processing and storage operations. The costs increases of energy, gas, foils, cartons, plastic foils, inert gas, etc. had to be incorporated into increased pricing for storage and processing.

5. Pesticide residua

A) Supplement to the instruction regarding spraying within previous year:

Basic trends of the hop protection, as well as protection of other agriculture commodities are fully subject to the rules valid in European Union.

B) Newly used pesticides:

By comparison of the Methodology of the Hop Protection in 2022 and 2021 we registered following changes.

The inclusion of new preparations into the methodology of the hops protection in 2022:

Name of Preparation	Active Substance	Effectiveness
Mšice-Molice STOP	Acetamiprid	hop aphid
Exirel	Cyantraniliprol	alfalfa snout weevil
Carial Flex	Cymoxanil, Mandipropamid	hop aphid
Karma	Pottasium bicarbonate	powdery mildew

The inclusion of new preparations into the methodology of the hops protection in 2022:

Name of Preparation	Active Substance	Effectiveness
Curzate K	cymoxanil + oxychlorid-Cu	downy mildew of hops
Kuprikol 250 SC	oxychlorid-Cu	downy mildew of hops

C) Control system for pesticide residues

Chmelařský institut, s.r.o. Žatec (Hop Research Institute, s.r.o. Žatec) in this year did not receive any instructions in order to change the control system of pesticide residues, so that it goes on in compliance with the present trends. Connection to EUROFINS SOFIA GmbH Berlin, an international certified laboratory, continues and in compliance with the facilities of the laboratory we extend also the spectrum of analyses of active substances. Simultaneously, in this year we extended even more the cooperation with Chmelařský institut s.r.o. Žatec, which is equipped – since 2016 - with new laboratory facilities for analyses of pesticide residues and since 2020 its accreditation ČIA according to the standard ČSN EN ISO/IEC 17025:2018 was approved.

D) Protection of hops in the crop year 2022

The protection of hops in 2022 carried out by our suppliers was subject to the Methodology of the Protection of Hops for the year 2022 and of the List of the Preparations Approved for the Protection of Hops in 2022, issued for the companies Chmelařství, co-operative Žatec, and Bohemia Hop, a.s. Žatec. Due to the fact that we have agreed in the Contracts for Dried Hops, concluded with the suppliers, an obligatory deadline for sending of the "List" until the 31st March of the current year, we need to know possible requirements for the adaptation of allowed chemical preparations before that day, preferably up to 28th of February of current year.