



SVALBARD GLOBAL SEED VAULT

Annual Progress Report 2022



NordGen report on the agreement on the funding, management and operation of the Svalbard Global Seed Vault.

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Front page photo: The first nanofilm labels containing information about the content inside were attached to seed boxes in 2023. Nanofilm strips will over the years be attached to all seed boxes in the Seed Vault. Photo: NordGen.

2022 at a glance

- In total 69,825 safety duplicates from 31 depositors were added to the Seed Vault collection in 2022. By the end of the year the total holding of seed accessions in the Seed Vault was 1,195,244 samples deposited by 93 genebanks/institutes.
- Four gene banks deposited seeds for the first time in 2022, located in Spain, Lithuania, Iraq and Uruguay. Representatives from the national genebanks in Spain and Lithuania were present and accompanied their seed deposits at the Seed Vault Opening in June.
- The Seed Vault International Advisory Panel had its third meeting back-to-back to the seed deposit event in October. At the same occasion around 50 heads of mission/ambassadors located in Oslo attended when new seed samples were brought into the Seed Vault. Eight of them assisted when seed boxes from their home countries were deposited.
- New samples of test seeds belonging to the 100-year seed germination experiment in the Seed Vault produced by NRSSL, Thailand and NordGen were deployed in the Seed Vault in 2022.
- Fixing of box wise nanofilm labels displaying data on seed samples stored in the seed boxes in the Seed Vault started in 2022.

Foreword

NordGen manages and operates the seed deposits at the Svalbard Global Seed Vault in partnership with the Norwegian Ministry of Agriculture and Food (LMD) and the Global Crop Diversity Trust (Crop Trust) and in accordance with the Three Party Agreement between the partners, signed for ten years and valid from 1st of July 2017.

The objective of the Seed Vault is to provide a safety net for the international conservation system of plant genetic resources, and to contribute to securing the maximum amount of plant genetic diversity of importance to humanity for the long term. The success of the Seed Vault has continued this year both measured in terms of participation from the global genebank community and in terms of public interest and awareness about the purpose of the Seed Vault. By the end of 2022, the Seed Vault holds 1,195,244 safety duplicates representing wide inter- and intra-specific crop diversity deposited by 93 genebanks from around the world.

We take this opportunity to thank our partners LMD and the Crop Trust for the good collaboration. I would also like to thank Statsbygg for the cooperation and the excellent working relationship we have at Svalbard.

It is with great satisfaction we see that the confidence and global interest for the Svalbard Global Seed Vault and for depositing seeds has remained on a high level also in 2022.

Lise Lykke Steffensen
Executive director NordGen

1. Introduction

This annual progress report for the Svalbard Global Seed Vault gives an overview of the NordGen operation of the Seed Vault and related activities in 2022. NordGen's responsibilities are stated in the Three-Party Agreement providing for the long-term funding, management and operation of the Svalbard Global Seed Vault. The annual progress report is prepared by NordGen in accordance with obligations in the Three-Party Agreement Article 3.19.a).

The overall guidelines for the NordGen mission is to fulfil the objectives for the Svalbard Global Seed Vault as they are expressed in the standard deposit agreement between depositors and the Royal Norwegian Ministry of Agriculture and Food, saying that the Seed Vault was established with the *"objective to provide a safety net for the international conservation system of plant genetic resources, and to contribute to the securing of the maximum amount of plant genetic diversity of importance to humanity for the long term in accordance with the latest scientific knowledge and most appropriate technique"*.

The operation of the Seed Vault is collaborative at several levels. At the management level NordGen collaborates closely with LMD and Crop Trust. At the facility operation level NordGen cooperates with Statsbygg in Longyearbyen. At the seed logistics level, we cooperate with the institutions sending safety duplicates as well as the chain of logistics and security partners involved in shipment and transport to the Seed Vault. The partnerships at all levels have worked very well also in 2022.

2. Seed deposits and depositors in 2022

In total, 31 genebanks deposited 69,825 seed samples in 2022, which is a significant increase compared to 2021, especially when it comes to the number of active depositors. Three Seed Vault openings were organized, as scheduled and pre-announced.

Three genebanks deposited seeds at two occasions, and four genebanks deposited seeds for the first time in 2022:

- State Forest Service, Lithuania
- Spanish Plant Genetic Resource Centre, Spain
- Instituto Nacional de Investigacion Agropecuaria, Uruguay
- Directorate of Seed Testing and Certification, Iraq

By the end of 2022 NordGen has on behalf of LMD, signed Deposit Agreements (DA) with 102 institutions. Out of these 93 are active depositors, and by the end of the year the total holding of seed accessions in the Seed Vault was 1,195,244.

Table 1. Seed Vault deposits and dates in 2022. The total number of deposited samples is 69,825.

Depositor / Date of deposit			
14th of February	Acronym	Inst. Code	Accessions
Julius Kühn Institute	JKI	DEU451	5
The Australian Pastures Genebank	SARDI	AUS167	6242
National Agricultural/ and Food Centre	SVKPIEST	SVK001	452
Leibniz Institute of Plant Genetics and Crop Plant Research	IPK	DEU146	4715
Agr. Plant Genetic Resources Conservation and Research Centre	APGRC	SDN002	479
Nordic Genetic Resource Center	NordGen	SWE054	1350
Suceava Genebank "Mihai Cristea"	BRGV	ROM007	461
International Centre for Agricultural Research in Dry Areas	ICARDA	LBN002	6336
Margot Forde Germplasm Centre	AGRESEARCH	NZL001	234
9th of June			
Genetic Resources Institute, University of Banja Luka	GRIBL	BIH039	227
World Vegetable Centre	AVRDC	TWN001	11113
Seed Savers Exchange	SSE	USA974	99
Plant Breeding and Acclimatization Institute	IHAR	POL003	1025
State Forest Service	VMT	LTU021	123
Centro Internacional de la Papa	CIP	PER001	81
Spanish Plant Genetic Resource Centre	CSIC	ESP004	979
International Centre for Agricultural Research in Dry Areas	ICARDA	LBN002	3446
Uganda National Genebank	UNGB	UGA528	169
Africa Rice Centre	AfricaRice	CIV033	1142
Station Federale de Recherches en Production Vegetale de Changins	AGROSCOPE	CHE001	944
10th of October			
RDA genebank/National Agrobiodiversity Center	RDA	KOR011	3392
Instituto Nacional de Investigacion Agropecuaria	INIA	URY003	1892
Australian Grains Genebank	AGG	AUS165	10383
Institute of Plant Genetic Resources "Konstantin Malkov"	BGRIPGR	BGR001	1186
The Brazilian Agricultural Research Corporation	Embrapa	BRA008	365
Plant Gene Resources of Canada	PGRC	CAN004	257
James Hutton Institute	JHI	GBR251	383
Directorate of Seed Testing and Certification	SBSTC-MOA	IRQ001	418
Julius Kühn Institute	JKI	DEU451	2
National Bureau of Plant Genetic Resources	NBPGR	IND001	3067
Plant Breeding and Acclimatization Institute	IHAR	POL003	4665
Centro Internacional de Mejoramiento de Maiz y Trigo	CIMMYT	MEX002	3811
Suceava Genebank "Mihai Cristea"	BRGV	ROU007	82
National Rice Seed Storage Laboratory for Genetic Resources	NRSSL	THA012	300
Total number of accessions deposited 2022			69825

Three depositors are not included in the publicly accessible part of the Seed Portal interface. These are institutions that have deposited seed samples with special permissions from the Norwegian Ministry of Agriculture and Food. These deposits are not belonging to the main seed deposit policy and the design of the publicly available part of the Seed Portal which is based on PGRFA crop species and single accessions as basic units. These are the Millennium Seed Bank, Kew (depositing seed mixture samples), the Forest Research Institute, Myanmar (depositing non-PGRFA orchid seeds) and the University Centre in Svalbard (depositing non-PGRFA seeds from the wild flora in Svalbard).

Seven depositors have made organizational changes as mergers, name changes and shift of FAO WIEWS institute codes. After a formal procedure, the changes have been implemented in the Seed Portal database and the ownership of deposited seeds has been transferred to the new institute designated as the valid owner. Details about the genebanks in question can be found in the table in Annex 1. By the end of 2022, four genebanks have signed the DA, but not yet deposited seeds.

Table 2. Deposited and withdrawn seed accessions pr year and in total for the years 2008-2021. Figures showing status at the end of each year.

Year	Deposited pr year	Deposited in total	Withdrawals	Current holdings
2008	320549	320549		320549
2009	169505	490054		490054
2010	111101	601155		601155
2011	113364	714519		714519
2012	58078	772597		772597
2013	29155	801752		801752
2014	38052	839804	3 ¹⁾	839801
2015	36130	875934	38073 ²⁾	837858
2016	42979	918913		880837
2017	64403	983316	54354 ²⁾	890886
2018	92638	1075954		983524
2019	32572	1108526	24064 ^{2) 3)}	992032
2020	82501	1191027	40 ⁴⁾	1074533
2021	50926	1241953		1125419
2022	69825	1311778		1195244
Totals		1311778	116494	1195244

¹⁾ Three *Hordeum* accessions withdrawn by NordGen for regeneration

²⁾ ICARDA withdrawals in 2015, 2017 and 2019

³⁾ Seven *Secale* accessions withdrawn by Agroscope, Switzerland for regeneration

⁴⁾ 40 samples withdrawn from the 2020 seed deposit before departure from ICARDA. The figure is registered in the Seed Portal.

A complete list of signatories and deposited seed samples are shown in Annex 1. Further details and key figures for the years 2017 to 2022 for seed deposits, stored boxes, depositors and seed deposit events are shown in Annex 3.

Twelve of the current 93 depositors are International Agricultural Research Institutes (IARCs), 73 are national gene banks and universities, two are regional genebanks and five are NGO gene bank collections. One of the depositors is a private company that has deposited seeds in cooperation with the country's government (Singapore).

Figure 1 shows the proportion and numbers of safety duplicates deposited by different categories of genebanks by the end of 2022. The largest share (57,9%) of the current holdings in the Seed Vault is deposited by IARCs represented by institutes belonging to the Consultative Group of International Agricultural Research Centres (CGIAR), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the Asian Vegetable Research Centre (AVRDC) and the Tropical Agricultural Research and Higher Education Centre (CATIE), all holding collections of PGRFA in trust for the UN Food and Agriculture Organisation (FAO).

Two depositors are regional genebanks, SPGRC and NordGen, standing for 3,36% of the total number of deposited accessions, while 38,32% of the seed samples in the Seed Vault have been deposited by national genebanks and universities.

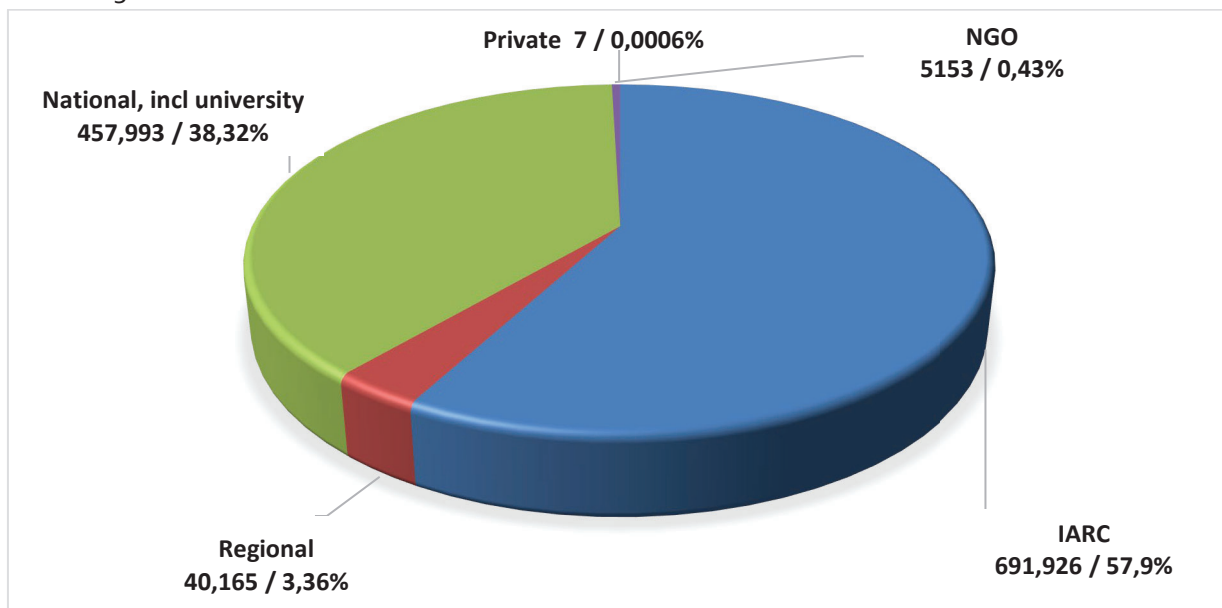


Figure 1. The proportion and numbers of safety duplicates currently deposited in The Vault at the end of 2022 by different categories of genebanks.

In total, 216 seed deposit boxes were taken into the Seed Vault in 2022. Over the years, 3731 regular seed boxes have been deposited in the Seed Vault. 325 boxes have been taken out, and consequently the number of regular seed boxes in the Seed Vault at the end of 2022 is 3406.

In addition, there are 75 boxes registered as test boxes in the Seed Vault. Eight genebanks have deposited test samples in one or more separate boxes. Four boxes marked as test boxes in the database contain seeds that are not categorized as regular crop seeds in the Seed Portal database (pasture seed mixtures from the Millennium Seed Bank, orchid seeds from the Forest Research Institute, Myanmar and seeds from the wild flora in Svalbard, deposited by the University Centre in Svalbard).

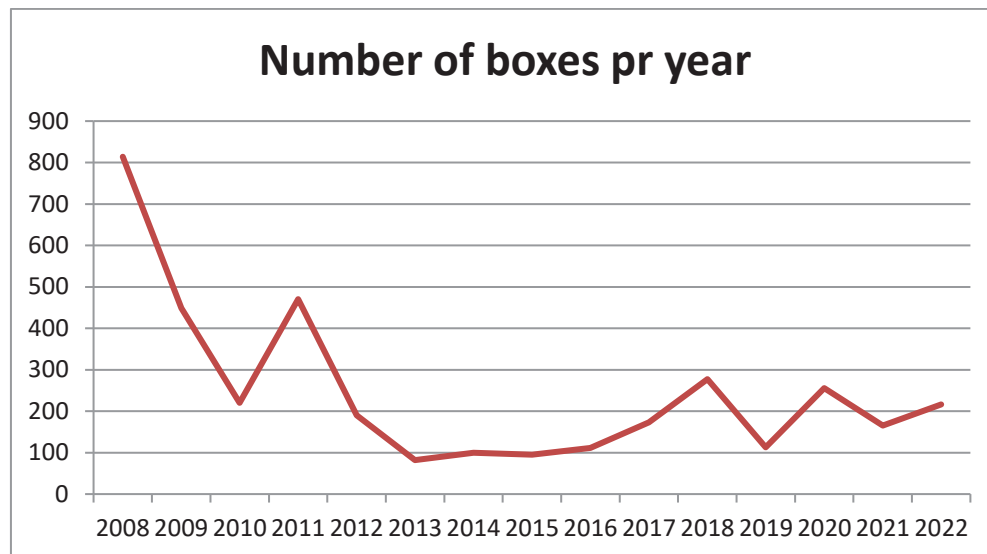


Figure 2.
Numbers of boxes deposited per year 2008-2022. (Withdrawals not shown.)

Seed shipment logistics imply that depositor genebanks send their seeds directly to Svalbard. Three seed shipments have been organized and covered by Crop Trust (from Uganda, Sudan and Bosnia & Herzegovina).

Logistics at Svalbard have been handled in collaboration with the local company Pole Position Logistics, who pick up the seed boxes upon arrival, store them temporarily until the Seed Vault opening date and bring the boxes to the airport for scanning and to the Seed Vault afterwards.

Security screening of seed boxes upon arrival in Svalbard has been handled in collaboration with Avinor at Longyearbyen airport and the security company Avarn Security Aviation AS. Avinor has introduced new routines for their services to the Seed Vault: scanning must be booked one month in advance and the service is invoiced. Statsbygg has provided support with logistics and technical backstopping in Svalbard and accompanied at all work inside the Seed Vault.

3. Data management

NordGen maintains and updates the Seed Portal database. The Seed Portal keeps accurate records of deposited seed samples, depositors, species, seed deposit events etc., and it displays basic data in a publicly accessible interface at <https://seedvault.nordgen.org/>.

A new version of the Seed Portal database was implemented in 2021. The Seed Portal 2.0 offers improved routines for quality assurance of information provided in accession lists submitted by depositors. Important functionalities are routines for controlling accuracy of taxonomy. Genus and species names that were already registered in the database have been updated in accordance with internationally agreed taxonomy. The task of reviewing, harmonizing and correcting around 13,000 taxon names is in progress.

By the end of the year, 1146 genera and 6095 species are represented in the Seed Vault. After the cleanup of the genera and species names, these figures reflect the true diversity of plant species conserved in the Seed Vault. By the end of 2022, 12,109 taxon names are registered. This figure will be further reduced during the taxonomy reviewing process.

In total, 34 datasets have been validated and uploaded to the Seed Portal in 2022 (24 in 2021).

4. The International Advisory Panel

The third meeting of the International Advisory Panel (IAP) was organized in Longyearbyen on the 11th and 12th of October 2022. IAP members for the third meeting have been:

- Yasmina El Bahloul, INRA, Morocco, Chairperson
- Lavern Gueco, University of the Philippines, Los Baños
- Ana Maria Barata, Instituto Nacional de Investigação Agrária e Veterinária, Portugal
- Axel Diederichsen, Plant Gene Resources Canada
- Stefanos Fotiou, FAO
- Marie-Noelle Ndjiondjop, AfricaRice, Cote d'Ivoire
- Kristin Børresen, Graminor, Norway
- Lise Lykke Steffensen, NordGen, Secretary IAP

The meeting was attended by observers from Crop Trust (Stefan Schmitz and Janny van Beem), FAO/ITPGRFA (Kent Nnadozie) and the Norwegian Ministry of Agriculture and Food (Grethe Evjen and Geir Dalholt).

For different reasons, IAP members Marie-Noelle Ndjiondjop, Axel Diederichsen and Stefanos Fotiou were not able to attend the meeting in Longyearbyen in person. However, they attended in the discussions through online platforms. Even taking part in the IAP inspection of the the Seed Vault interior

on Tuesday the 11th of October 2022 worked well through digital platforms. This experience may pave the way for fully or partly organizing future IAP meetings without physical meetings and long travels, which will enable more environmentally friendly meeting arrangements.

IAP members concluded that the upgrade of the Svalbard Global Seed Vault which was completed in 2019 has led to major improvements of the facility, and it recommended the Seed Vault partners to further enhance the written protocols describing the work conducted in the Seed Vault.

The IAP discussed the requirement of depositing genebanks to have a first-level back up of seeds before using Svalbard Global Seed Vault as the second-level backup, and if this could constitute a hindrance for genebanks to back up their seed collections. IAP also stressed that each depositing genebank is responsible for monitoring viability of its seed samples and suggested that routines and protocols for replacement of deposited seed samples in the Seed Vault should be developed. It was also recommended to translate the depositor guidelines to more languages and make these available on-line.

The IAP Secretariat led by NordGen has been in touch with the IAP members through the year and provided updates and relevant information. It is appreciated that IAP members have acted as ambassadors for the Seed Vault during 2022.

5. Public awareness activities

In accordance with the Three Party Agreement and with the work plan and budget for 2022, NordGen has worked considerably with public outreach activities, in cooperation with the partners. Information about the Svalbard Global Seed Vault has been passed on through several platforms: responding to questions about the operation from the public and from media, presentations and lectures for different scientific and public audiences, social media posts and written articles and giving press interviews. NordGen has produced information, text and photos for information material and the Seed Vault official web site. Information about lectures and one written proceeding article in 2022 are found in annexes 4 and 5. A large part of the presentations have been given through on-line platforms.

NordGen has through 2022 participated in the Seed Vault Communication Group consisting of the three partners; the Norwegian Ministry of Agriculture and Food, Crop Trust and NordGen organized by the Ministry. Responsibility for updating social media accounts have been shared between the partners. NordGen has been responsible for updates at the Seed Vaults' Instagram account. The LMD has updated Facebook and Crop Trust has been responsible for the Twitter account.

During 2022 the interest and attendance by media is more or less back to normal levels, as before the covid-19 pandemic. NordGen has received media teams and given interviews at all three Seed Vault opening occasions. Several interviews are also given by on-line platforms. All three deposit occasions were combined with special visits and events.

13th to 15th of February:

- a) Representatives of the Norwegian Government, Minister of Agriculture and Food, Sandra Borch and minister of International Development, Anne Beathe Tvinneim, attended the Seed Deposit Ceremony and assisted when the first nanofilm labels were attached to the seed boxes.
- b) A team from the Slovak genebank accompanied their second seed deposit and recorded footage for a documentary about their project for duplicating their seed collection in the Seed Vault.
- c) Crop Trust organized video scanning for producing a virtual tour of the Seed Vault.

7th to 10th of June:



Figure 3. Left: Two genebanks deposited seeds for the first time in June 2022, the State Forest institute I Lithuania, here represented by Bronislovas Gelvonauskis and the Spanish Plant Genetic Resource Centre, here represented by Angeles Gomez Borrego and Luis Guasch Pereira.

Below: Michael Haddad, UNDP Regional Goodwill Ambassador, delivered the “Package of hope,” from Pope Francis to the Seed Vault. His walk from Longyearbyen to the Seed Vault was accompanied by representatives from the Holy See, UNDP, ICARDA and FAO.



- a) In June 2022 two genebanks deposited seeds for the first time, State Forest Service in Lithuania and the Spanish Plant Genetic Resource Centre. Both genebanks were represented with institute representatives. The Lithuanian delegation also included Lithuanian politicians, media and representatives from the Nordic Council of Ministers Office in Lithuania, who supported the deposit operation.
- b) Michael Haddad, United Nations Development Programme (UNDP) Regional Goodwill Ambassador, delivered the “Package of hope,” from Pope Francis to the Svalbard Global Seed Vault, after a walk for Climate Resilience and Food Security from Longyearbyen centre to the Seed Vault. The package comprised seed samples from twelve Arab countries provided by ICARDA and a handmade copy of the Popes’ book “Why are you afraid?”. The walk was accompanied by representatives from the Holy See, UNDP, ICARDA, FAO and media.
- c) Seminar in the technical building “Sicherheit, Klima, Wandel – Brennpunkt Arktis” for the German Bundesakademie für Sicherheitspolitik, organized by the German Ministry of Defense, in cooperation with Norway’s Ministry of Foreign Affairs and Crop Trust.

10th to 12th October:



Figure 4. Ambassadors from eight countries assisted when seed boxes were taken into the Seed Vault on the 12th of October 2022. Dr. Devendra Kumar Yadava (left) and Dr. Tilak Raj Sharma from the NBPGR Genebank in India were assisted by India’s ambassador to Norway Dr. B. Bala Bhaskar (Right) when seeds from the Indian national genebank were deposited.

- a) A seed deposit ceremony was organized for Oslo Heads of Mission excursion to Svalbard, (around 50 ambassadors stationed in Oslo) organized by the Norwegian Ministry of Foreign Affairs. Eight ambassadors assisted when seed boxes from genebanks located in their home countries were taken into the Seed Vault.

- b) The International Advisory Panel attended the ceremony.
- c) Two genebanks were represented and assisted when their seed deposits were taken into the Seed Vault; the RDA genebank, South-Korea and ICAR, NBPGR genebank, India. The South-Korean delegation also included a video photographer for making a documentary about the RDA program for depositing seeds in the Seed Vault.

NordGen has received and responded to a significant number of emails from media, scientists, politicians and the public during 2022. No exact statistics are made, but the number of emails is estimated to be at the same level as in 2021.

6. Long term seed storage experiments

The *100 year Seed Longevity Experiment in the Svalbard Global Seed Vault* started in 2020. The project includes seeds of 14 different crops and six genebanks as project partners producing seeds for the experiment. The plan is that seeds will be produced and deployed in the Seed Vault over the next 2-3 years, and that identical samples will be taken out and analyzed for germination every tenth year. Partners and crops are shown in table 3.

Table 3. Crops and genebank institutes included in the experiment.

Institute	Providing seeds of crops
National Rice Seed Storage Laboratory for Genetic Resources (NRSSL), Thailand	Rice (<i>Oryza sativa</i>)
Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Germany	Barley (<i>Hordeum</i>), pea (<i>Pisum</i>), wheat (<i>Triticum</i>), lettuce (<i>Lactuca</i>) and <i>Brassica oleracea</i> ³⁾
The International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), India	Groundnut (<i>Arachis</i>), chickpea (<i>Cicer</i>), pearl millet (<i>Pennisetum</i>), Sorghum and pigeon pea (<i>Cajanus</i>)
Instituto Nacional de Investigação Agrária, INIAV, Portugal	Maize (<i>Zea mays</i>)
Empresa Brasileira de Pesquisa Agropecuária (Embrapa), Brazil	Soybean (<i>Glycine max</i>)
Nordic Genetic Resource Centre, Sweden	Timothy (<i>Phleum pratense</i>)

Project partners located outside Europe have experienced difficulties and delays regarding shipment of seeds produced for the project, partly due to the options for shipment during the pandemic and partly due to bureaucracy in the home countries. This situation has improved significantly during 2022; Embrapa has now produced and shipped all samples for the project (three sets of seed samples produced over three different years), delivery of rice samples from NRSSL in Thailand will be finalized with the shipment of the third seed during 2023, and ICRISAT have shipped one set of all five species (two sets of chick pea).

Delivery of seeds from the European partners (IPK, INIAV and NordGen) is conducted according to schedule. Current status for deliveries and deployments of test samples in the Seed Vault is shown in table 4.

Despite the delays, NordGen is quite confident that all planned seed samples will be produced, prepared and placed in the Seed Vault according to the schedule, meaning that all samples will be in place during the first half of 2025.

Table 4. Status of seed production and deliveries, drying and packing process and deployment of test samples to the 100-year longevity experiment in the Seed Vault pr. 31st of March 2023.

Species	Provider	Status pr 31.03. 2023
Rice	NRSSL	One set in Seed Vault, 2nd set in drying process, 3rd set produced
Barley	IPK	Two sets in Seed Vault, 3rd set in drying process
Pea	IPK	Two sets in Seed Vault, 3rd set in drying process
Wheat	IPK	Two sets in Seed Vault, 3rd set in drying process
Lettuce	IPK	Two sets in Seed Vault, 3rd set in drying process
Cabbage	IPK	First set in Seed Vault, 2nd and 3 rd set in drying process
Soybean	Embrapa	Two sets in Seed Vault, 3rd set in drying process
Groundnut	ICRISAT	First set in drying process
Chickpea	ICRISAT	First set in Seed Vault, 2nd set in drying process
Pearl millet	ICRISAT	First set in drying process
Pigeon pea	ICRISAT	First set in Seed Vault
Sorghum	ICRISAT	First set in drying process
Maize	INIAV	Two sets in Seed Vault, 3rd set produced
Timothy	NordGen	First set in Seed Vault, 2nd set in drying process

From 2022 NordGen has taken over the responsibility for the 100 year experiment in the coal mine, including budgetary coverage. The 35 year storage test set was taken out of the coal mine in February 2022 and tested in accordance with the test plan. Germination results will be shared with Seed Vault partners.

7. Accession data on nanofilm

It has been decided to increase the security and integrity of the data about seed samples that are deposited in the Seed Vault by printing data on nanofilm. Preparing data was completed and film labels for the first around 3100 boxes were produced in 2021. The first film labels were fixed to a couple of boxes by the Norwegian Ministers Sandra Borch and Anne Beathe Tvinnereim in February 2022.

NordGen staff has attached film labels to between 300 and 350 seed boxes during 2022. The task has turned out to be more labor demanding than first thought. Completing the task will continue during 2023.

8. The BOLD project

The BOLD project (Biodiversity for Opportunities, Livelihoods and Development) was launched in 2021 as a 10-year project to strengthen food and nutrition security worldwide by supporting the conservation and use of crop diversity. BOLD is funded by the Government of Norway and managed by Crop Trust.

One part of BOLD includes a scheme for supporting multiplication, packing and shipment of genebank material for being deposited in the Seed Vault. Around 90 applications for support from genebanks were received during 2022, and around 60 were preselected for further evaluation. NordGen participated in the evaluation and selection process before the Crop Trust project management entered negotiations with the selected genebanks. By the end of 2022, around 30 contracts have been signed. It is expected that due to BOLD support the number of genebanks that deposit seeds in the Seed Vault will increase significantly during the next 2-3 years.

9. Financial result

Key figures for funding and the financial result and account wise budget and spending for 2022 are shown in Annex 2. The financial result, as the difference between budget and spending for 2022, summarized for core activities and projects shows a total surplus of SEK 63,092. More in detail, the core activity budget shows a total budgetary deficit of SEK 43,821, while the project accounts show a total surplus of SEK 106,913.

The deficit in the core activity accounts is related to higher travel costs and a slight re-allocation between management and administration of the Seed Vault project. In particular, the IAP meeting required considerably more resources than budgeted for.

The surplus in the two project accounts is related to delayed deliveries of seeds for the 100 year experiment. Unspent project budget is suggested to be carried forward for activities in subsequent years. More details account wise below.

Budgeted funding from partners was in total SEK 3,230,278 while the actual contributions from the three partners mounted SEK 3,308,145. A positive currency exchange rate between SEK and Euro added SEK 77,867 to the overall funding.

Directing and interaction with partners

Total spending compared to the budget shows a deficit of SEK 79,263. This is partly due to increased costs in travel and accommodation and more time spent on administration and management.

Administration, planning and documentation

Total spending shows a surplus of SEK 70,352. This surplus is due to re-allocating of working hours from this account to data management for the Seed Vault coordinator.

Liaising with depositors and handling of seeds

Total spending for 2022 shows a minor surplus, and spending is quite in line with the budget.

Data management

Total spending shows a deficit of SEK 51,462 indicating about 20% overspending. The new version of the Seed Portal has allowed for a higher level of accuracy in registered and utilized taxa, and a significant number of working hours have been spent on reviewing and harmonizing accumulated taxonomy registers in the Seed Portal.

Communication attracting new depositor genebanks

Total spending shows a surplus of SEK 4,310, which is quite in line with the budget. Less travels have been compensated by increased and consolidated online communication with a significant number of potential depositor genebanks. Communication within the BOLD project, including information and guidelines towards potential new depositors constitutes a significant part of this activity area.

Public awareness activities

Total spending compared to the budget shows a surplus of SEK 13,250 which is quite in line with budget. Travel costs have been slightly reduced compared with previous years due to increased use of virtual meetings and on-line presentations.

International Advisory Panel

Total spending shows a deficit of SEK 19,935. The third meeting of the International Advisory Panel was organized in October 2022. In summary, the spending has been quite in line with the budget. It is, however, worth noting that despite three of the IAP members didn't participate in person, the total travel costs have been higher than budgeted. This fact illustrates that travel and accommodations cost for organizing meetings in Svalbard are significantly higher than before the pandemic.

Long term storage experiment

Total spending compared to the budget shows a surplus of SEK 182,816. Due to the pandemic, parts of the new project *Long Term Storage Experiment in the Seed Vault* have, as explained above, been delayed. The main reason for this is that participating genebanks outside Europe have not been able to send seeds for the experiment as planned. Seeds are produced, but the final shipment part has been problematic. Consequently, labour costs and spending on chemical analysis have been lower than budgeted in 2022.

Some of the unspent budget has been re-allocated to extra working hours in the other of the two projects included in the Seed Vault budget, equipping seed boxes with nanofilm labels with printed accession data. Unspent project budget will be needed the following years to cover postponed activities on preparing seed samples and seed analysis.

Conserving data on long-term storage medium

Total spending for this project shows an overspending of SEK 75,903 compared to the budget. Attaching label holders with nanofilm strips to the seed boxes has been more labour demanding than expected. Due to this, NordGen staff went for an extra trip to Svalbard and worked two and a half days focused on work with the nanofilm in the Seed Vault.

Annex 1. List of depositors to the Svalbard Global Seed Vault listed in order of Deposit Agreement signature. Updated pr 31. Dec. 2022.

Acronym	Country	Institute name	Wiews code	SDA	Accessions end 2022
WARDA	International, Ivory Coast	Africa Rice Center	CIV033	2007/2008	20619
CIAT	International, Columbia	Centro Internacional de Agricultura Tropical	COL003	2007/2008	57534
CATIE	International, Costa Rica	The Tropical Agricultural Research and Higher Education Center	CRI001	2007/2008	1314
ILRI	International, Ethiopia	International Livestock Research Institute	ETH013	2007/2008	6282
ICRISAT	International, India	International Crop Research Institute for the Semi-Arid Tropics	IND002	2007/2008	117713
ICRAF	International, Kenya	World Agroforestry Centre	KEN023	30.01.2008	1536
CIMMYT	International, Mexico	Centro Internacional de Mejoramiento de Maiz y Trigo	MEX002	2007/2008	181641
IITA	International, Nigeria	International Institute of Tropical Agriculture	NGA057	2007/2008	23333
CIP	International, Peru	Centro Internacional de la Papa	PER001	2007/2008	9696
IRRI	International, Philippines	International Rice Research Institute	PHL001	2007/2008	126447
ICARDA	International, Lebanon / Morocco	International Centre for Agricultural Research in Dry Areas	SYR002/ LBN002	2007/2008	106865
AVRDC	International, Taiwan	The World Vegetable Center	TWN001	2007/2008	40260
NORDGEN	Regional, Sweden	Nordic Genetic Resource Center	SWE054	30.01.2008	28170

IPK	Germany	Leibniz Institute of Plant Genetics and Crop Plant Research	DEU146	30.01.2008	64231
CGN	Netherlands	Centre for Genetic Resources	NLD037	30.01.2008	21703
PGRI-NARC	Pakistan	Plant Genetic Resources Institute, National Agricultural Research Centre	PAK001	30.01.2008	4932
SSE	USA	Seed Savers Exchange	USA974	30.01.2008	4210
NGBK	Kenya	Kenya Agricultural & Live-stock Research Organisation (KALRO): Genetic Resources Research Centre	KEN015	26.02.2008	1314
NAC / RDI	South Korea	National Agrobiodiversity Center	KOR043	06.05.2008	Transferred to KOR011 ^{*)}
IAS	North-Macedonia	Institute of Agriculture Skopje	MKDxxx	11.06.2008	0
NBPGR	India	National Bureau of Plant Genetic Resources	IND001	04.07.2008	3292
VIR	Russia	N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry	RUS001	04.07.2008	6082
RAC	Switzerland	Station Federale de Recherches en Production Vegetale de Changins	CHE001	27.10.2008	11321
EMBRAPA	Brazil	The Brazilian Agricultural Research Corporation	BRA008	06.11.2008	5122
AFT	Ireland	Oak Park Research Centre	IRL001	16.01.2009	577
DAFF	Ireland	Department of Agriculture, Food and Rural Development	IRL029	22.01.2009	435
TARI	Taiwan	Taiwan Agricultural Research Institute	TWN006	26.02.2009	10503
UAAS	Ukraine	Institute of Plant Production n.a. V.Y. Yurjev of UAAS	UKR001	03.03.2009	2782

PGRC	Canada	Plant Gene Resources of Canada, Canadian Genetic Resources Program	CAN004	05.11.2009	32212
ILRF	Georgia	I. Lomouri Research Institute of Farming.	GEO001	23.02.2010	305
AAS	North Korea	Pyongyang AAS	PRK013	18.03.2010	5700
UNALM	Peru	Universidad Nacional Agraria La Molina	PER002	25.05.2010	1296
ICCI	Israel	Institute of Cereal Crop Improvement, Tel Aviv University	ISR003	23.06.2010	900
DELEP	USA	Desert Legume Program. University of Arizona	USA971	24.08.2010	134
ARC	Sudan	Agricultural Research Corporation	SDN034	18.10.2010	Transferred to SDN002 ^{*)}
SPGRC	Regional, Zambia	SADC Plant Genetic Resources Centre	ZMB030	09.11.2010	11995
NAGREF	Greece	National Agricultural Research Organization	GRC035	02.02.2011	25
ICABIOGRAD	Indonesia	Indonesian Center for Agricultural Biotechnology and Genetic Resources	IDN179	02.02.2011	1050
MPGRPPD	Myanmar	Department of Agricultural Research	MMR003	23.02.2011	718
INIAP	Ecuador	Instituto Nacional Autónomo de Investigaciones Agropecuarias	ECU076	12.04.2011	168
NARO	Uganda	National Agricultural Research Organization	UGA031	26.05.2011	Transferred to UGA528 ^{*)}
BARI	Bangladesh	Plant Genetic Resource Centre, Bangladesh Agricultural Research Institute	BGD164	10.06.2011	0
LSB	Italy	University of Pavia, Dep. of Earth and Environmental Sciences, Lombardy seed bank	ITA411	23.06.2011	2

NACGRAB	Nigeria	National Centre for Genetic Resources and Biotechnology	NGA010	06.09.2011	800
IRAG	Guinea	Institut de Recherche Agronomique de Guinée	GIN020	07.10.2011	0
RNGRC	Tajikistan	Republican National Genetic Resource Center	TJK027	14.11.2011	1646
AGRI	Azerbaijan	Genetic Resources Institute of the Azerbaijan National Academy of Sciences	AZE015	17.02.2012	1522
INRB	Portugal	Instituto Nacional de Recursos Biológicos	PRT005	05.03.2012	Transferred to PRT001 ^{*)}
ISABU	Burundi	Agricultural Research Institute of Burundi	BDI003	19.06.2012	829
IER	Mali	Institute of Rural Economy	MLI002	19.09.2012	758
PSARTI	Mongolia	Plant Science Agricultural Research Institute	MNG030	02.10.2012	360
INIA La Platina	Chile	Unidad de Recursos Genéticos -INIA La Platina	CHL002	03.10.2012	Transferred to CHL044 ^{*)}
AUG	Georgia	Georgia State Agrarian University	GEO028	15.10.2012	120
NPGRL	Philippines	National Plant Genetic Resources Laboratory	PHL129	18.10.2012	2254
ASAU	Armenia	Armenian State Agrarian University, Laboratory of Plant Gene Pool and Breeding	ARM035	16.12.2012	175
CN FCRC	Thailand	Chai Nat Field Crops Research Center	THA214	01.03.2013	150
UZRIPI	Uzbekistan	Uzbek Research Institute of Plant Industry	UZB006	01.03.2013	2038
SARDI	Australia	South Australian Research and Development Institute	AUS006	12.06.2013	Transferred to AUS167 ^{*)}

AGG	Australia	Australian Grains Genebank/Australian Tropical Crops Collection	AUS165	26.11.2013	27152
BWPRC	Japan	National University Corporation Okayama University	JPN009	26.11.2013	5268
NRSSL	Thailand	National Rice Seed Storage Laboratory for Genetic Resources, Rice Department	THA012	14.08.2013	994
AGES	Austria	Austrian Agency for Health and Food Safety, Dept. for Plant Genetic Resources	AUT001	17.03.2014	2358
BGRIPGR	Bulgaria	Institute for Plant Genetic Resources "K.Malkov"	BGR001	17.03.2014	2119
NCGRP	USA	National Center for Genetic Resources Preservation, USDA	USA996	SIGNED 18.01.2015	135237
NFSC	Norway	The Norwegian Forest Seed Centre	NOR056	08.01.2015	208
Luke	Finland	Natural Resources Institute Finland	FIN027	21.01.2015	7
CRI	Czech Republic	Crop Research Institute	CZE122	28.08.2015	1467
UCR-CIA	Costa Rica	Universidad de Costa Rica	CRI092	08.09.2015	Transferred to CRI003 ^{*)}
PdeP	Peru	Parque de la Papa	PER862	09.09.2015	750
AGRESEARCH	New Zealand	Margot Forde Germplasm Centre	NZL001	11.1.2016	2597
CHAIPATT	Thailand	Chaipattana Foundation	THA513	11.2.2016	34
APG	Australia	Australian Pastures Gene Bank	AUS167	11.3.2016	34735
GRIBL	Bosnia & Herzegovina	Genetic Resources Institute, University of Banja Luka	BIH039	16.6.2016	1148
INRA	France	National Institute for Agricultural Research	FRA040	16.6.2016	2

TLL	Singapore	Temasec Life Sciences Laboratories Ltd.	SGP008	19.8.2016	7
JHI	UK	James Hutton Institute	GBR251	09.11.2016	1416
MNREC	Myanmar	Myanmar Ministry of Natural Resources and Environmental Conservation	MMR075	09.11.2016	491
RPCNASBAF	Belarus	Scientific Practical Centre of the National Academy of Sciences of Belarus for Arable Farming	BLR011	17.01.2017	341
ETKI	Estonia	Estonian Crop Research Institute	EST019	25.10.2017	133
SVKPIEST	Slovak Republic	National Agricultural and Food Centre	SVK001	08.01.2018	1082
INIAV	Portugal	Banco Português de Germoplasma Vegetal	PRT001	26.02.2018	618
INIA	Chile	Instituto de Investigaciones Agropecuarias	CHL044	06.04.2018	145
DOA	Thailand	Department of Agriculture, Ministry of Agriculture and Cooperatives	THA032	09.08.2018	55
UKVGB	United Kingdom	University of Warwick	GBR006	13.08.2018	1090
LSFRI	Latvia	Latvian State Forest Research Institute "Silava"	LVA009	28.10.2018	153
BDNA	South-Korea	Baekdudaegan National Arboretum	KOR048	03.06.2019	10
APGRC	Sudan	Agricultural Plant Genetic Resources Conservation and Research Centre	SDN002	13.09.2019	2643
JKI	Germany	Julius Kühn Institute	DEU451	30.09.2019	13
IHAR	Poland	Plant Breeding and Acclimatization Institute	POL003	09.10.2019	8547
BRGV	Romania	Suceava genebank "Mihai Christea"	ROM007	23.10.2019	959

MSB, Kew	United Kingdom	Royal Botanic Gardens, Kew	GBR004	18.12.2019	2
UCR	Costa Rica	Universidad de Costa Rica	CRI003	08.09.2015 (as CRI092)	57
LARI	Lebanon	Lebanese Agricultural Research Institute	LBN020	14.01.2020	453
ICGB	Israel	Wild Cereal Genebank, University of Haifa	ISR037	30.03.2020	323
CN	USA	Cherokee Nation	USA1005	21.01.2020	9
INRA	Morocco	Institut National de la Recherche Agronomique	MAR123	24.02.2020	983
JIC	United Kingdom	John Innes Centre, Germplasm Resources Unit	GBR247	10.07.2020	4334
RDA / NAC	South Korea	RDA genebank/National Agrobiodiversity Center	KOR011 (former KOR043)	12.10.2020 New code confirmed	30272
IFVCNS	Serbia	Institute of Field and Vegetable Crops	SRB002	23.08.2021	96
UNGB	Uganda	Uganda National Genebank	UGA528 (former UGA031)	06.09.2021 New code confirmed	946
CSIC	Spain	Agencia Estatal Consejo Superior de Investigaciones Cientificas	ESP004	28.02.2022	979
VMT	Lithuania	State Forest Service	LTH021	28.04.2022	123
INIA	Uruguay	Instituto Nacional de Investigacion Agropecuaria,	URY003	12.08.2022	1892
SBSTC-MOA	Iraq	Directorate of Seed Testing and Certification	IRQ001	29.08.2022	418
IPGR	Albania	Institute of Plant Genetic Resources	ALB026	24.10.2022	0

*^y) Names and details of gene banks to which previous deposits have been transferred can be found further down in the list.

Annex 2. Budget and spending 2022

Budget and Spending - Svalbard Global Seed Vault NordGens management and operation 2022

Activity area/activity	Budget currency SEK	Actual currency SEK	Diff mot budget	
Directing and interaction with partners				
Project no 709513				
Management and meetings	285 772	344 872		
Management assistance and meetings	68 127	62 770		
Travels	45 000	70 520		
Sub-total	398 899	478 162	-79 263	
Administration, planning and documentation				
Project no 709524				
Administration management	81 381	20 735		
Support accounts, archive & logistics	66 459	111 971		
Support project coordinator	0	0		
Documents and background information	476 889	415 766		
Travels	0	5 906		
Sub-total	624 730	554 378	70 352	
Liaising with depositors and handling of seeds				
Project no 709515				
Communication & Seed handling	340 635	338 875		
Seed handling in Svalbard	84 427	70 029		
Travel	140 000	141 308		
Contracted services	35 000	30 924		
Sub-total	600 062	581 136	18 926	
Data management				
Project no 709514				
IT & Seed Portal support	33 584	22 116		
Preparing datasets and Seed Portal update	204 381	263 690		
Contracted services	0	0		
Travel	12 000	15 621		
Sub-total	249 965	301 427	-51 462	
Communication attracting new depositor gene banks				
Project no 709525				
Communication activities	204 381	238 970		
Travel	40 000	1 101		
Sub-total	244 381	240 071	4 310	
Public awareness activities				
Project no 709516				
Respond to enquiries, lectures/articles, website	340 635	339 656		
Serve media, produce material, website & SE	0	0		
Travel	35 000	22 729		
Sub-total	375 635	362 385	13 250	
International Advisory Panel				
Project no 709517				
Secretary	357 216	449 580		
Secretary assistance	65 721	0		
Logistics arrangements	70 890	19 794		
Travel	120 000	169 733		
Meeting costs	100 000	94 654		
Sub-total	713 826	733 761	-19 935	
Long term storage experiment Coal Mine #3				
Project no 709519				
Location hire (coal mine #3)	0	0		
Seed Analysis	0	0		
Sub-total	0	0	0	
	Basic grants Svalbard incl IAP 709517	3 207 499	3 251 320	-43 821
	Basic grants Svalbard excl IAP 709517	2 493 673	2 517 559	-23 886
Long term storage experiment in the Seed Vault				
Project no 709529				
Coordination	0	0		
Preparing and handling of test samples	95 667	52 697		
Seed technician	40 000	22 896		
Contracted seed analysis program	110 500	0		
Shipment costs	40 000	27 758		
Sub-total	286 167	103 351	182 816	
Conserving data on long-term storage medium				
Project no 709523				
Administration	0	0		
Compiling data	0	30 044		
Contracted services	225 000	270 859		
Sub-total	225 000	300 903	-75 903	
	Sub-total	511 167	404 254	106 913
	Total SEK	3 718 666	3 655 574	63 092
	Total EURO	374 730	351 160	23 570
	Crop Trust Funding 2022	1 342 703	1 420 570	77 867
	NordGen Funding 2022	108 243	108 243	0
	Sum	1 450 946	1 528 813	77 867
	LMD Funding 2022	1 779 332	1 779 332	0
	Total Funding from partners	3 230 278	3 308 145	-77 867
	Contribution from Working capital fund 2022		347 429	
	Total Funding 2022		3 655 574	
	Working capital fund 31 dec 2021	866 191		
	Working capital fund 31 dec 2022		518 762	

Annex 3. Key figures - deposits and depositors

Seed deposits, depositors, seed boxes in the Seed Vault and seed deposit events for 2017-2022, actual numbers for each year and accumulated figures.

Year	2017	2018	2019	2020	2021	2022
Seed accessions ^{1) 2)}						
Accessions deposited	64403	92638	32572	82501	50926	69825
Deposited in total, by 31.12	983316	1075954	1108526	1191027	1241953	1311778
Withdrawals	54354		24064	40		
Withdrawals in total by 31.12.	92430	92430	116494	116534	116534	116534
Seed Vault collection by 31.12	890886	983524	992032	1074533	1125419	1195244
Depositors						
Depositors	15	30	7	42	22	31
New depositors	3	3	3	8	2	4
Depositors in total by 31.12	74	77	80	87	89	93
New signatories	2	6	6	5	1	5
Signatories in total by 31.12	79	85	91	96	97	102
Number of deposit events	4	3	4	3	3	3
Seed boxes ¹⁾						
Number of deposited boxes	173	277	113	256	165	216
Deposited boxes in total	2704	2981	3094	3350	3515	3731
Number of retrieved boxes	161		36			
Retrieved boxes in total	289	289	325	325	325	325
Boxes in Seed Vault by 31.12	2415	2692	2769	3025	3190	3406

¹⁾ Test seed samples and test boxes are not included.

²⁾ Deposited seed samples not registered in the Seed Portal database are not included. These are seeds from Svalbard native flora, orchid seeds from Myanmar and pasture seed mixtures deposited by Royal Botanical Gardens, Kew in the UK.

Annex 4. Lectures and presentations 2022

Åsmund Asdal:

- 15.2. Svalbard Global Seed Vault. Updates on seed deposits, Presentation for Norwegian Ministers and guests. Technical building at the Svalbard Globale Frøhvelv.
- 15.2. Svalbard Globale Frøhvelv – Noahs ark for frø i Arktis. Romerike Trainee, study tour to Svalbard. Longyearbyen.
- 16.2. Svalbard Global Seed Vault. Introduction – what tourists should know. Svalbard Guide Training Course organized by Visit Svalbard, Longyearbyen, Svalbard.
- 15.3. Svalbard Global Seed Vault – how seed conservation in the Arctic can secure future food supplies. Workshop 15.-17. March. Investigación y acción social al servicio de la agricultura. Centro de Investigaciones Agronomicas, University of Costa Rica, San Jose.
- 04.4. Svalbard Global Seed Vault - Basic information. On-line lecture at the event of the dedication of the new NordGen office building in Alnarp, Sweden.
- 22.4. Why are seeds the key to our future? Exponential Climate Action Summit V: Nature in the Race to Zero. Webinar organized by We Don't Have Time, Stockholm, Sweden.
- 28.4. Svalbard Global Seed Vault. On-line Tangent Design talk for students at Monash Art Design & Architecture, Monash University. Melbourne, Australia.
- 09.6. The Svalbard Global Seed Vault. Its mission and operation. Seed deposit ceremony – SFS, Lithuania and CSIC, Spain. Lecture in the maintenance building at the Seed Vault for visiting delegations from Lithuania and Spain at the occasion of depositing seeds for the first time by genebanks in these countries.
- 10.6. What visitors to the Museum should know about the Svalbard Global Seed Vault. Lecture for staff at Svalbard Museum, Longyearbyen. Svalbard Museum.
- 06.7. Conserving duplicates of genebank collections in the Svalbard Global Seed Vault. On-line presentation for partners in the Seeds for resilience program, organized by Crop Trust.
- 25.9. Svalbard Global Seed Vault – how conserving seeds in the Arctic can secure future food supplies. Terra Madre event; Seeds, plants and flowers swap! Turin, Italy. On-line lecture.

14.10. What visitors to the Museum should know about the Svalbard Global Seed Vault. Lecture for staff at Svalbard Museum, Longyearbyen. Svalbard Museum.

2.11. The Svalbard Global Seed Vault – securing seeds and genetic resources for the future. ISTA Seed Symposium. Quality Seeds for Sustainable Agriculture. Athens, Greece, 2-4 November 2022.

9.11. Svalbard Global Seed Vault – conservation of plant genetic resources in the Arctic. Brazilian Congress on Genetics Resources, organized by Embrapa. On-line lecture.

16.11. Svalbard Global Seed Vault – how seed conservation in the Arctic can secure future food supplies. Cupar Rotary Club, Scotland. On-line lecture.

16.11. Svalbard Global Seed Vault – how seed conservation in the Arctic can secure future food supplies. Cape Fear Chapter, NC Wildlife Federation, USA. On-line lecture.

Stefan Schmitz and Åsmund Asdal

10.6. The Svalbard Global Seed Vault. Its mission and operation. Presentation for Bundesakademie für Sicherheitspolitik. Brennpunkt Arktis. Technical building at the Svalbard Globale Frøhvelv.

Annex 5. Publications 2021

Publications about the Svalbard Global Seed Vault by NordGen staff

Asdal, Å. 2022. The Svalbard Global Seed Vault: securing seeds and genetic resources for the future. Abstracts. ISTA Seed Symposium 2022. Quality Seed for Sustainable Agriculture. Athens, Greece. 02-04 November 2022. Published by International Seed Testing Association (ISTA), Richtiarkade 18, CH-8304 Wallisellen, Switzerland.

