Introduction

SASA’s origins go back to 1914 and the founding of Scottish Seed Testing Service. This was combined with seed potato work on a new site at East Craigs in 1925, followed by gradual expansion and addition of functions over the succeeding decades. However it proved increasingly difficult to adapt the East Craigs site to the demands posed by 21st Century science. This, along with the effects of urban expansion, resulted in a move from East Craigs to purpose-built facilities at Roddinglaw in 2005. SASA was made an Executive Agency in 1992, a position reversed in 2008 when it was established as a Division within the Agriculture Food and Rural Communities (AFRC) Directorate of the Scottish Government (SG). The Directorate was restructured in 2016 when Elinor Mitchell took over as Director. The Directorate is now called Agriculture and Rural Economy (ARE).

SASA holds an unusual position within the SG (and the wider UK civil service) and within Scottish science. It is a part of the core civil service, yet it is made up of scientists rather than the generalist policy-makers and administrators more typical of the civil service. It is a scientific organisation - but one that is geared primarily towards delivery of advice and services, rather than research.

The Head of SASA is also appointed as Scotland’s Chief Plant Health Officer (CPHOS) and is responsible for providing strategic and tactical leadership, across forestry, crops and the natural environment, to minimise the risk and impact of plant health threats in Scotland.

The appointment of the CPHOS and the creation of Plant Health Centre of Expertise to provide rapid call down evidence to inform policy decisions, demonstrates the Scottish Government’s drive to improve our plant health resilience.

Working closely with UK plant health service colleagues, the CPHOS is responsible for co-ordinating the Scottish Government’s plant health response in terms of policy, inspections and surveillance activities. In the event of a plant health outbreak, it is the CPHOS who will lead and coordinate the Scottish Government’s response and provide stakeholder guidance.

SASA Aims and Functions

The aim of SASA is to provide expert scientific policy and technical advice, statutory and inspection services and information around a core remit which covers: plant and bee health; seed certification; wildlife crime investigation; variety registration; genetic resources and biodiversity; genetically modified organisms (GMOs); and the protection of crops, food and the environment. That work is framed by relevant Scottish, UK, EU and other international legislation and agreements.

SASA’s principal customer is the Scottish Government, for which it provides advice and information to a range of internal policy partners, as well as delivering scientific services to external stakeholders on the SG’s behalf. As part of the latter, SASA processes applications, samples and data submitted by or gathered from Scottish rural businesses and provides results and advice to those customers. SASA also provides services and advice to other Government Departments as well as various UK and international bodies (including the EU); local government; academia, research institutes, and private companies, organisations and individuals.

SASA aims to represent the scientific and technical interests of the Scottish Government, and the wider UK, in international fora, particularly those involved in the regulation of the agri-environment sector to ensure new standards and regulations meet, and are appropriate for, UK and Scottish needs.
The principal functions of SASA are:

- To serve the needs of Scottish Agriculture and the Rural Environment on behalf of the Scottish Government, including the provision of the range of services set out in the SASA Business Plan;

- To provide Scottish Government policy makers, the Agricultural Inspectorate and other customers with scientific and technical expertise on the content and implementation of Scottish, UK, EU and other international legislation and agreements in relation to our core remit;

- To support the Scottish Government’s legislative and policy responsibilities and undertake and assist in ARE’s enforcement role through inspections and provision of appropriate scientific and technical services including: quarantine, diagnostics and measures to contain or eradicate plant and bee pests and diseases;

- To provide plant variety evaluation, description and maintenance in support of Plant Breeders’ Rights and National Listing of Crop varieties;

- To provide seed testing, crop inspection and identification in support of the Scottish Seed Certification and Seed Potato Classification Schemes and be the Certifying Authority for Scottish seed crops. Seed testing is also provided directly to customers for farm saved seed;

- To maintain appropriate variety collections to underpin variety registration and seed certification as well as provide a genetic resource collection particularly for varieties with Scottish and UK importance;

- To act as the genetically modified organism inspectorate and provide advice on GMOs;

- To conduct pesticide residue monitoring in food and wildlife, and conduct pesticide and biocide usage assessments in relation to the protection of crops, food and the environment;

- To provide analytical and forensic services in the investigation of wildlife crime;

- To provide advice on wildlife management to the SG and a wide range of stakeholder bodies;

- To represent Scottish and, where appropriate, UK and EU interests at national and international meetings which call for scientific and technical input for issues in our remit;

- To maintain and develop the scientific and technical competence needed to respond quickly and effectively to the evolving requirements of customers for scientific expertise and services, by maintaining a continuous programme of challenging and well-focused research and development;

- To improve the effectiveness of SASA by providing scientific and technical services to other customers in relevant areas of work;

- To provide policy support in the areas of Plant Health, Plant Varieties & Seeds, and Pesticides & Fertilisers;

- To provide inspection services with regards ensuring Plant Health and Marketing Standards are met, with specific focus on horticulture; and

- To proactively publish SASA’s data, where possible, for the public good.
The SASA approach

A number of key principles and working relationships underpin SASA’s work including:

**Translational science**

Although SASA is not primarily a research organisation, its R&D is essential to its continued ability to deliver scientific advice and scientific services. Approximately 10% of its budget is spent on R&D and is concentrated on development, drawing on research carried out in academia and research institutes such as the James Hutton Institute, translating this into practical applications. As well as core funding, SASA’s research is also funded by competitive grants from bodies such as EU FP7, The SG’s Contract Research Fund (CRF), the Agriculture and Horticulture Development Board (AHDB), etc. which are used to fund fixed-term appointments and PhD studentships. An essential component of this strategy is SASA’s participation in science networks such as Edinburgh Plant Science, the Scottish Consortium for Rural Research and CAMERAS (Coordinated Agenda for Marine, Environment and Rural Affairs Science).

**IT Strategy**

Digital systems are key to the effective day-to-day work of SASA. We maintain and develop bespoke databases, support the work of the Seed Potato Classification Scheme and Crop Certification allowing easy access to current and historic records both in SASA and remotely by RPID Inspectors. This data is also a great resource for scientific research across the agricultural community. We continue to drive forward with making as much of this information publically available through web applications such as europotato.org, which provides information on all European, cultivated potato varieties. We continue to improve our systems through innovations in accessibility and mobile working while preserving the security and integrity of our information.

**The Inspectorate delivery partners**

The Scottish Government’s agricultural inspectors in RPID are delivery partners for a range of SASA’s services, including the Seed Potato Classification Scheme, Seed Certification Scheme and plant health activities, complementing the activities of SASA’s in-house Horticulture and Marketing Inspectorate. Regular consultation and communication is essential for the effective functioning of this key relationship, including the delivery of services and provision of associated training and support. RPID and SASA both participate in the Science and Agricultural Services Committee.

**Science/Policy interaction**

SASA brings together in-house policy and scientific/technical specialists particularly with regards to Plant Health, Plant Varieties & Seeds and Pesticides & fertilisers. The close working relationship and seamless communication is held up as an example of best practice for science/policy partnership by the SG’s Chief Scientific Adviser.

**Partnership with industry**

SASA works closely with industry stakeholders, holding regular meetings to evaluate progress and discuss issues such as changes in legislation or new pathogens. This is backed by regular customer satisfaction surveys.
Organisation and Structure

- Permanent scientific staff
- Fixed Term appointments for research projects
- PhD students
- Business Support staff (library, IT, farm etc.)

Organised into 2 collections of branches, plus business support services:

### Chief Plant Health Officer for Scotland & Head of SASA - Gerry Saddler

<table>
<thead>
<tr>
<th>Deputy Chief Plant Health Officer and Head of Plant Health</th>
<th>Plant Health, Horticulture, Seeds &amp; Potatoes Policy Team</th>
<th>Horticulture &amp; Marketing Unit</th>
<th>Information Technology</th>
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<tr>
<td>Denise Athara</td>
<td>Debbie Kessell</td>
<td>Jason Rumens</td>
<td>Laura Well</td>
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### Head of Agricultural Science Delivery & Deputy Head of SASA - Jackie Hughes

<table>
<thead>
<tr>
<th>Variety Testing</th>
<th>OSTS</th>
<th>Seed Certification</th>
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<tr>
<td>Tom Christie</td>
<td>Valerie Cockburn</td>
<td>Mike Parker</td>
<td>Mike Taylor</td>
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<th>Potato</th>
<th>Virology &amp; Zoology</th>
<th>Pesticide Survey Unit</th>
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<tbody>
<tr>
<td>David Kenyon</td>
<td>Triona Davey</td>
<td>Jon Pickup</td>
<td>Gillian Ross</td>
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<tr>
<th>Farm (incl. Horticulture)</th>
<th>Vacant</th>
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### Head of Business & Support Services - Mark Rae

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<th>Library</th>
<th>Digital Imaging &amp; Presentation</th>
<th>Purchasing</th>
<th>Quality Assurance</th>
<th>Scientific Services Support Unit</th>
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<tr>
<td>Janice Elvie</td>
<td>Jill Tivey</td>
<td>Sylvia Breslin</td>
<td>Mark Frater</td>
<td>Susan Ross</td>
<td>Scott Higginson</td>
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T/PSH/AboutSASA
Resources and Facilities

Almost all SASA staff are based at the Roddinglaw laboratories and adjacent Gogarbank Farm. Three Horticulture & Marketing Unit staff are based at an office adjacent to the Glasgow Fruitmarket and a laboratory at the Moredun Research site is used for viroid testing.

The Roddinglaw laboratories were purpose-built and SASA transferred to Roddinglaw in 2005, moving from its previous site at East Craigs (where it had been based since the early 1920s).

Laboratory facilities include:

- Containment Unit – for working with non-indigenous plant pathogens
- Plant pathology laboratories
- UK Potato Quarantine Unit
- Potato collection of 1,000+ potato varieties in state-of-the-art storage facility
- Seed collections and long-term storage facility
- Molecular biology laboratory, including DNA wildlife forensic unit
- Seed testing laboratory
- Analytical chemistry laboratory
- Glasshouses

These are complemented by field-based activities on the surrounding Gogarbank Farm.

Branch Highlights

POTATO

Seed Potato Classification Scheme (SPCS)

The Potato branch manages the SPCS, the basis for Scotland’s seed potato production. This involves an annual area of approximately 11,000 ha, with a value of £100 million, underpinning the UK’s £3.5 billion potato industry. The Seed Potato Classification Scheme has been significantly restructured in 2015 with the introduction of new EU legislation, harmonising marketing across the EU. SASA represented the UK during negotiations and helped shape the final scheme.

The development of the SPUDS database transformed service delivery, in terms of cost-effectiveness and availability of management information. Growers can now make crop applications and follow inspection data online via MySPUDS, as well as print their own labels for marketing.

Production of pathogen-free starting material – nuclear stock

SASA’s nuclear stock unit holds a collection of over 800 disease-free potato microplants, which form the starting material of the Scottish seed potato industry once distributed to approved micropropagation laboratories for maintenance and further multiplication. The use of disease-free microplants maximises the quality and health of Scottish seed potatoes in the early generations.

New potato varieties being introduced to the collection are subject to a programme of official testing for indigenous and EU-quarantine pathogens, before they can be maintained by SASA, on behalf of potato breeders and the industry.
Training of inspectors

SASA staff work alongside Scottish Government inspectors to teach potato inspectors annually about growing crop and tuber diseases and faults. These courses are designed to maintain the skills and expertise of our inspectorate and conclude with participants completing a practical examination. SASA offers similar training to the potato industry.

Potato Pathology

Potato branch licences private micropropagation laboratories and carries out a monitoring programme of their output for the presence of plant pathogens. It also provides a diagnostic service in support of the inspectorate and industry, disseminating scientific and technical advice at grower events. Potato branch recently developed a molecular assay capable of differentiating closely related *Phoma* species as a time saving alternative to the conventional agar plate method which takes two weeks to complete.

Exports

SASA facilitates the worldwide trade in Scottish potatoes by developing long-term relationships with relevant authorities in importing countries to effect changes in plant health and import policies in these countries and to explore the possibilities of co-operation on technical issues.

Inward seed potato missions are organised by SASA and the AHDB with the aim of impressing the quality benefits from classification, testing, handling and inspection of seed potatoes in Scotland. Recent inward missions include, Kenya (2016), Cuba (2014) and Saudi Arabia and Vietnam (2013).

Virology & Zoology

Nematology

All land to be used for seed potato production must be tested for the presence of potato cyst nematodes (PCN) as seed potato cultivation is prohibited on land where these pests are found. About 17,000 soil samples are taken by government inspectors each year and sent to SASA for testing. The laboratory processes involve an automated cyst extraction system (carousel) and a novel PCR diagnostic applied to the soil extract. Results are recorded on SASA’s in-house seed potato database (SPUDS) which generates the clearance certificate, a pre-requisite to any seed potato production. We disseminate information on PCN epidemiology, particularly the increasing prevalence of *Globodera pallida*, and provide advice on the management of these pests.

Entomology

Aphids are particularly important pests of potatoes as they spread viruses within crops, significantly reducing the yield and quality. We operate a network of four suction traps within Scotland, identifying aphids caught in these traps. During the seed potato growing season we provide weekly updates on SASA’s internet site assessing the risk of virus transmission and weekly e-mail summaries to interested parties.
**Virology**

SASA monitors virus incidence and virus species population dynamics in support of the SPCS by providing diagnoses and advice on the epidemiology, control and management of prevalent (aphid-transmitted) viruses. In recent years, Potato virus Y has become the major virus threat to Scottish potatoes, a situation observed in other potato growing areas worldwide. SASA has recently implemented a suite of molecular assays for the rapid detection of several virus species in dormant tubers (including Potyvirus species, viruses causing leaf roll and spraying diseases). We also carry out applied scientific research and disseminate scientific outputs to the potato industry and the wider scientific community (UK and worldwide).

**Bee Health**

V&Z provides diagnostics and technical advice, and co-ordinates surveillance to support policy, inspectors and beekeepers in the identification and control of statutory bee diseases and non-native invasive pests. In addition, SASA is closely involved in supporting the Scottish Honey Bee Health Strategy (SHBHS) and the Pollinator Strategy for Scotland (PSS). These stakeholder partnerships extend SASA’s involvement beyond statutory responsibilities towards supporting bee health and sustainable bee populations in Scotland.

**DIAGNOSTICS, WILDLIFE & MOLECULAR BIOLOGY**

**Molecular Biology**

The team have taken a leading role in the development of molecular assays to support statutory services initially through the creation of a high-throughput system for the detection and differentiation of PCN but more recently focusing on aphid species which act as vectors of potato viruses. This has subsequently led to development of work on the vectors of both Liberibacter and *Xylella fastidiosa*.

Following the development of microsatellite markers for the identification of potato varieties and the creation of a European database this technology has been adopted as the first stage of the DUS process in Europe with SASA acting as the coordinating laboratory. Recent collaboration with Canadian researchers has added North American cultivars to the database and UPOV have recently proposed that this system is adopted globally.

**Fingerprinting**

SASA developed a rapid and robust potato variety identification system, based on microsatellite markers technology, that allows unknown samples to be compared with over 1500 DNA fingerprints of potato varieties held in a searchable database for identification purposes. The service was established to assist Scottish Government inspectors, but is now offered as a commercial service to the potato industry with customers from around the globe. Recent collaboration with Canadian researchers has added North American cultivars to the database and UPOV have recently proposed that this system is adopted globally.
Monoclonal Antibody Unit

Antibodies developed and produced by SASA for the detection of potato viruses are recognised for their high specificity and selectivity. Originally developed for in-house testing needs they have subsequently been marketed externally through third party companies and more recently directly to researchers and diagnostic laboratories including some based in both North and South America and Asia with sales revenue doubling in the last three years.

R&D

The Euphresco network coordinates trans-national phytosanitary R&D in Europe and has led to a number of important projects at SASA including work on Liberibacter, Xylella fastidiosa, Epitrix, PCN and bacterial pathogens of potato enabling collaboration with a large number of European partners.

The research funding base has expanded from potato council and Scottish Government to include BBSRC, Innovate UK (formally TSB), industry and the charity sector and currently generates revenue of over £0.5M per annum.

Alternative disease control strategies are an important focus of externally funded research programmes with the team recognised for its work on understanding the biofumigation process. Other elements of the programme include the use of polysulphides and trap crops in the management of PCN and phage in the control of Pectobacterium and Dickeya spp.

Studying the epidemiology and control of a variety of bacterial diseases of potato has been a major focus in recent years. A collaborative network involving JHI, Fera, SRUC and SASA has furthered our understanding of pathogen spread and facilitated in the development of control strategies for Clavibacter michiganensis subsp. sepedonicus, Dickeya solani and Pectobacterium atrosepticum and Ralstonia solanacearum, with funding from the CRF and Potato Council.

In collaboration with In collaboration with sVirology and Zoology, research on the epidemiology and diagnosis of ‘Candidatus Liberibacter solanacearum’ has started to elucidate this complex host-pathogen interaction detecting this pathogen in the UK for the first time and identify new vectors and disease haplotypes.

Wildlife and the Environment

The Wildlife DNA Forensics unit carries out forensic animal DNA testing for criminal investigations. The majority of these cases relate to wildlife crime – such as bird of prey persecution, poaching and the trade in endangered species – but it also carry out casework human crimes such as robbery and murder where animal DNA evidence is recovered. Its research focuses on the development of new methods that can help answer investigative questions for wildlife crimes. We are working with the University of Edinburgh to deliver a masters course in “Applied Conservation Genetics with Wildlife Forensics” and are actively involved in the harmonization of wildlife forensic standards globally.

SASA provides advice on all aspects of wildlife management from rodenticide use to seagull management in town centres. Recent work has centred on the potential impact of animal traps on non-target species, understanding Wild Boar populations in Scotland and adaptive management programme for protected (Annex 1) goose species.

Following outbreaks of two notifiable bee diseases, SASA has become involved in a wide range of projects with academia and the industry in support of the Scottish Honey Bee Health Strategy. Linked to this is work aiding our understanding of pollen source utilisation by bees at a landscape scale.
**PLANT HEALTH**

**Potato Quarantine**

Potato material coming into the UK from outside of the EU (for example, for use in plant breeding or to market a variety already established elsewhere) must pass through the UK Potato Quarantine Unit (PQU). The PQU, which operates under EU Plant Health Directives 2000/29/EC and 2008/61/EC, is also an accredited offshore potato quarantine station for Australia and New Zealand. This helps protect the multi-million pound potato industries in the EU, Australia and New Zealand against the introduction of quarantine and regulated non-quarantine pests by applying one of the most comprehensive testing regimes used world-wide. Potato material from outside of the EU must pass through the PQU. Most of its assays are accredited to the quality standard ISO 17025.

**Bacteriology**

Provides pathology support for the SPCS by conducting diagnoses and surveillance on pathogens such as *Dickeya* and *Pectobacterium* species (blackleg), which are of plant health concern to the Scottish industry. In addition, monitoring work ensures Scotland’s continued freedom from *R. solanacearum* (potato brown rot) and *C. michiganensis* subsp. *sepedonicus* (potato ring rot).

Successful conclusion of eradication programme for *Ralstonia solanacearum* in the Tay river system. Introduction of legislation in 2010 to control infection by *Dickeya solani* in potato and demonstrable freedom from the pathogen since its introduction.

**Potato Viroids**

Plant Health and Biosecurity Branch operates a specialist testing laboratory for the detection of pospiviroids in potatoes and other solanaceous crops and ornamentals, the latter in cooperation with SASA’s Horticultural Inspectorate. Successful interceptions have included: *Potato spindle tuber viroid* in potatoes imported through post-entry quarantine; and *Tomato chlorotic dwarf viroid* in traded Petunia. All infected material was destroyed.

**Horticultural pathology**

In addition to dealing with outbreaks of several new tree pests, SASA was involved in work on several new *Phytophthora* species: identifying the risks of *Phytophthora ramorum* and *P. kernoviae* to Scottish heathlands; epidemiology of *Phytophthora ramorum* and *P. kernoviae* at two historic gardens in Scotland; identifying new hosts for *P. lateralis* (*Thuja occidentalis* and *T. plicata*) and collaborating in the development of an assay for *P. austrocedri*.

**HORTICULTURE AND MARKETING UNIT**

The Horticulture and Marketing Unit (HMU) ensures that plant pests and diseases are not introduced into Scotland and plant material exported from Scotland does not present a risk to trading countries. Inspections are carried out on imported and exported plants and plant products at plant producer and production sites. Surveillance and monitoring of the trade is also undertaken and when serious pests are identified control measures are implemented.
HMU undertake conformity checks to ensure that the quality and marking requirements of the fruit and vegetable marketing standards are met throughout the distribution chain and enforce the regulations when non-compliance is identified. HMU also collect data on horticultural business in Scotland and analyse applications for EU-supported funding for Scottish agro-businesses.

HMU inspectors role will include:

- Carrying out surveillance and managing outbreaks of specific plant pests, and take action to prevent potential spread;
- Ensuring compliance with controls (including plant passports) on the movement of plants and plant products within the EU;
- Inspecting plants and plant products entering Scotland from countries outside the EU;
- Inspecting plants and plant products exported to non-EU countries;
- Operating certification schemes for Narcissus and soft fruit;
- Enforcing the EU marketing standards for fresh fruit and vegetables at all stages;
- Marketing from import or packing, through the wholesale and distributive sectors, to the final point of retail sale.

### PLANT HEALTH, HORTICULTURE, SEEDS & POTATOES POLICY

The SASA policy team work with the other areas of SASA and industry to develop and review Scottish Government’s policies on a wide range of topics including plant health, varieties and seeds, pesticides, fertilisers, seed potatoes and horticulture. The team also works with Defra and the other devolved administrations to share information and knowledge so we can work together to ensure a cohesive policy approach to these topics across the UK where appropriate. The team is also responsible for advising Ministers and preparing legislation.

### VARIETY TESTING

SASA Variety Testing carries out the UK/EU function of DUS (Distinctness, Uniformity & Stability) and VCU (Value for Cultivation and Use) testing in support of legislation covering the marketing of new varieties and the intellectual property rights involved in plant breeding. Field and glasshouse trials are undertaken each year to internationally recognised standards and across a range of vegetable species.

As well as statutory testing, SASA Variety Testing is responsible for the AHDB Potatoes IVT (Independent Variety Trials) programme, with an associated contract to provide the information to growers through a web-based database. As a result of its near 50 year involvement with DUS, VCU & IVT, SASA Variety Testing has built up a unique series of well-characterised reference collections of its test crops (stored at -22°C). We also host the Scottish Landrace Protection Scheme which functions as a “safety-net” for locally adapted and traditional Scottish genetic resources by storing this material and making it available both to the original donors in case of harvest failure, as well as the wider research and breeding communities.
SEED CERTIFICATION

Cereal Crops

Seed Certification branch manages the Scottish Seed Certification Scheme, including administration and organisation of the certification and enforcement of crops including Cereals, Herbage, Oil Seed Rape, Peas and Beans and Brassicas. It also operates annual training courses in crop and seed identification, and seed sampling for SG and Trade Inspectors and Samplers. These are attended by Scottish Government staff and by inspectors and samplers working for the trade.

The following table shows the number of cereal crops and area certified in Scotland in the last three seasons.

<table>
<thead>
<tr>
<th>Year</th>
<th>No of Crops</th>
<th>Area Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>971</td>
<td>8261.72</td>
</tr>
<tr>
<td>2016</td>
<td>934</td>
<td>8041.64</td>
</tr>
<tr>
<td>2015</td>
<td>882</td>
<td>7997.74</td>
</tr>
</tbody>
</table>

Spring Barley is the dominant crop accounting for 59% of the area certified in 2017 with Winter Wheat at approximately 18% being the next most significant area.

Certification inspections are carried out by a combination of official inspectors employed by Scottish Government and Licensed Inspectors employed by the trade. Trade inspectors are subject to monitoring regimes which includes check inspections and refresher training and testing.

The SEEDS database certification module went live in February 2014 and is central to certification work, recording all seed samples, seed lots, crop entries, inspections and results. MySEEDS, originally went live in mid 2015 and with subsequent enhancements allows customers to enter information directly on to the database and to view their own data. Clients and stakeholders were involved throughout the development process.

A molecular technique using Single Nucleotide Polymorphisms (SNPs) as molecular markers for identification of barley varieties has been developed. This uses a set of 38 markers which can identify the barley variety using a reference genotype.

Regulation of Genetically Modified Organisms (GMOs)

The GM team provides science advice on all aspects of GMOs to SG Policy staff and Ministers, as well as related survey work and GM testing. The Scottish GM Inspectorate is also based at SASA.

The GM team manage the authorisation process in Scotland, for work involving GMOs, both in laboratories (contained use) and in the open air (deliberate release). SASA staff assess the risk to the environment for new work involving the contained use of GMOs. The team perform molecular testing for GM events and have ISO17025 accreditation for DNA extraction from maize and oilseed rape, screening for the detection of adventitious GMO events in maize and oilseed rape, and quantification of two GM events.

The GM screen using five qualitative PCRs can reliably detect positive certified reference material at levels of 0.1% and above. In the future it is hoped to achieve flexible scope accreditation to cover DNA extraction and quantification of all EU authorised GM events.
OFFICIAL SEED TESTING STATION (OSTS)

Seed Testing
The OSTS provides seed testing services to Scottish Government, the seed trade and growers. The service offers a wide range of laboratory tests including germination, purity, seed identification, disease and vigour for species of agricultural, horticultural, flower, tree, herb and medicinal seeds. Annually the OSTS receives approximately 4000 samples with the number of tests requested around 7500-9000 depending on the season. To ensure that all results sent to the customer are accurate and traceable, the OSTS continues to maintain accreditation to both the International Seed Testing Association (ISTA) which includes seed sampling and UKAS (ISO/IEC Standard 17025). Underpinning the work of the OSTS is a highly developed and competent team of analysts as well as specialists in seed pathology, seed physiology and seed technology. Providing our customers with notification of sample receipt and faster reporting, the SEEDS database provides a cost effective, efficient and robust system of recording data, reporting and decision making.

Supervision of Licensed Seed Testing Stations and Samplers
In support of the Scottish Seeds (Licencing and Enforcement etc.)(Scotland) Regulations the OSTS monitors and supervises five Licenced Seed Testing Stations in Scotland and together with the Seed Certification section undertake monitoring and supervision of Licensed samplers.

Training
In support of Scottish and EU Legislation the OSTS provides seed analysis, and laboratory management training for the UK Seed trade in collaboration with the OSTS’s for England and Wales and Northern Ireland. The OSTS is also responsible for sampler training and training courses are ran jointly with the Seed Certification Section. It also provides seed technology, seed health and seed identification training to meet the requirements of individual customers from within the UK and Internationally.

R&D
A programme of R&D aims to improve testing methods and enhance the interpretation and application of tests results to the benefit of the Scottish Government, Scottish Agriculture and the Scottish Environment. This is done in house as well as through collaboration with other organisations within the UK and Internationally. Examples in recent years include work on seed vigour testing, effect of Microdochium spp on spring cereals; Fusarium spp/ Mycotoxins (Aberdeen University, SRUC, Food Standards Scotland); harmonisation of pea disease varietal resistance tests in Europe (GEVES and CPVO) and validation of seed testing methodology (ISTA Technical Committees).

PESTICIDES
The Pesticides Branch primarily conducts statutory EU monitoring of pesticides.

Pesticides Survey Unit
Agrochemical pesticide usage patterns are surveyed by the Pesticide Survey Unit (PSU). In 2014 information was collected from over 500 Scottish growers. In addition to statutory work the PSU also gathers and analyses data to support Scottish Government policy. In 2014 the unit conducted a survey of the effects of EU restrictions on neonicotinoid seed treatments on
farmers in order to inform the SG policy position. The unit is also performing an analysis of the potential effects of changes to EU legislation on pesticide availability and the impact on Scottish agriculture to inform policy and aid their discussions with the farming sector. The PSU publishes its results widely to increase their utility and accessibility. In 2012 a public access database was launched and from 2014 all report data were published in accessible spreadsheets alongside the National Statistics accredited reports. The unit’s data are used by a large number of organisations to inform and direct their research, advice and monitoring programmes.

**CHEMISTRY**

SASA’s Analytical Chemistry specialists utilise state of the art measurement science systems and constantly develop new test methods needed to satisfy the relentless demand for chemical residue monitoring of our food, flora and fauna.

**Pesticide Residues in Food**

Chemistry Branch incorporates an official UK testing laboratory that facilitates the Scottish Governments’ continued participation in UK and EU annual Pesticide Residues in Food (PRiF) monitoring programs. The PRiF team are able to detect, identify and quantify residues of hundreds of different pesticides that could remain in or on our food. This monitoring ensures that residues do not exceed approved levels and pose a threat to human health. The PRiF team also regularly participate in UK and EU proficiency tests that provide independent feedback on their analytical performance.

**Operation of Scotland’s Wildlife Incident Investigation Scheme (WIIS-Scotland)**

The Wildlife Incident Investigation Scheme (WIIS) conducts surveillance of various pesticides, anticoagulant rodenticides (rat poisons) and veterinary medicines in wildlife, beneficial insects (e.g. bees), livestock and pets in order to identify risks to (non-target) animals arising from the approved use of pesticides and also to provide evidence of misuse or deliberate abuse of pesticides that might be used in enforcement of legislation.

The scheme relies on members of the public and interested organisations to notify relevant agencies and facilitate submission of carcasses, suspected baits or other samples for chemical analysis. Agricultural Staff in area offices located throughout Scotland, provide support when necessary for field investigations, and also act as an additional point of contact for notification of incidents.

The veterinary services of Scottish Agricultural College (SAC) Consulting, a division of Scotland’s Rural College (SRUC) acts in partnership with the scheme, in forwarding relevant samples to SASA from potential incidents notified indirectly via its laboratories, and by screening out incidents that are unlikely to involve pesticides.
This is a priority for the Scottish Government. SASA has a range of staff involved in international representational work:

<table>
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<tr>
<th>Organisation</th>
<th>Function</th>
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| ISTA                                      | Vice-Chair ISTA Moisture Committee  
|                                           | ISTA Seed Symposium Convenor  
|                                           | Member Seed Science Advisory Group  
|                                           | Editorial board for the journal Seed Science and Technology                                                                                                                                                   |
| ISTA                                      | UK Voting Member  
|                                           | ISTA Executive Committee, member-at-large                                                                                                                                                                       |
| ISTA                                      | Member ISTA Bulking and Sampling Committee                                                                                                                                                                   |
| ISTA                                      | Vice-Chair ISTA Germination Committee  
|                                           | Member ISTA Vigour Committee  
|                                           | Member ISTA Proficiency Test Committee                                                                                                                                                                           |
| ISTA                                      | Seed Sampling Training                                                                                                                                                                                    |
| CPVO                                      | Potato Experts Group Member                                                                                                                                                                                |
| CPVO                                      | Vegetable Experts Group Member                                                                                                                                                                             |
| CPVO Project Harmores                     | UK Representative                                                                                                                                                                                        |
| International Plant Protection Convention Standards Committee | Chair from 2010 and member for Europe region (2008-2015)                                                                                                                                                   |
| European and Mediterranean Plant Protection Organization (EPPO) CPM Affairs Panel | Member (UK representative)                                                                                                                                                                                  |
| United Kingdom Plant Health Strategic Advisory Forum | Scottish Government Representative                                                                                                                                                                           |
| UPOV                                      | Technical Working Party for Vegetables Member                                                                                                                                                              |
| UPOV                                      | Working group on biochemical and molecular markers                                                                                                                                                           |
| UNECE Specialised section on Seed Potatoes | Delegate on the Working Party on Agricultural Quality Standards: Seed Potatoes                                                                                                                                 |
| UNECE                                     | Chair of Working Party on Agricultural Quality Standards: Seed Potatoes                                                                                                                                     |
| UNECE Specialized Section on Standardization of Fresh Fruit and Vegetables | UK Representative                                                                                                                                                                                        |
| SASA Export Liaison Officer for Scotland  | Representing Scottish Exporters on outward and inward missions to agree trading terms with authorities from across the globe.                                                                                 |
| OECD                                      | EUPHRESCO Epitrix                                                                                                                                                                                         |
| Various                                   | Coordination of transnational phytosanitary research                                                                                                                                                        |
| EPPO Potato Panel                         | Member (UK representative)                                                                                                                                                                                  |
| EPPO                                      | Panel on Virology and Phytoplasmology                                                                                                                                                                       |
| EPPO Mycology Panel                       | Member (UK representative)                                                                                                                                                                                  |
| United Kingdom Accreditation Service      | Auditor (auditing for accreditation services of UK, Finland and Slovenia)                                                                                                                                    |
| European Association for Potato Research  | Chair of the Virology Section from 2002-2008                                                                                                                                                              |
| Euphresco                                 | Coordination of transnational phytosanitary research                                                                                                                                                        |
| Various                                   | EUPHRESCO Virus Collect                                                                                                                                                                                    |
| Hortax                                    | Member of the Cultivated Plant Taxonomy Group                                                                                                                                                              |
| British Association of Seed Analysts      | Scottish Representative                                                                                                                                                                                    |
| Association of Applied Biologists         | Convenor of Nematology Group (2008-2013)                                                                                                                                                                   |
| ISPP Committee on Taxonomy of Plant Pathogenic Bacteria | Member since 1992                                                                                                                                                                                      |
| European Mycological Network              | Member (Scottish Government representative)                                                                                                                                                                |
In 1920 The Board of Agriculture purchased the 111 acre East Craigs farm on the then western outskirts of Edinburgh and in 1923 approval was given for the building of laboratory facilities there. By 1925 construction work had commenced and the Seed Testing Station and the Plant Registration Service were merged and set up operation on the site which was officially opened by Sir John Gilmour, Secretary for Scotland. At that time the site was shared with the Scottish Plant Breeding Station (SPBS) until it moved to Pentlandfield in the early 1950s. Craigs House and the old Empire Building were originally occupied by SPBS with Craigs House being the residence of the Director of the SPBS during this period.

During this early period ‘East Craigs’ was variously referred to as Scientific Services, the Official Seed Testing Station, Scientific Services (Agriculture) and Agricultural Scientific Services. For a time we held the title DAFS ASS – surely one of the least enviable acronyms ever coined.

In 1992 The Scottish Agricultural Science Agency was created as an executive Agency of the then Scottish Executive Environment and Rural Affairs Department. The autonomy served SASA well during ninety’s and noughties but in 2008 the political tide had turned against executive agencies and SASA rejoined the core of the Scottish Civil Service by becoming an integral part of the Scottish Government within the Agri-Environment portfolio.
The Farm

The East Craigs farm was used for field trials and post-control seed plots from the 1920s onwards. In the 1960s when it became apparent that the UK would finally be allowed to join the EU, the management at East Craigs realised that the farm would not be big enough to carry out all the support work needed for the EU seeds regime. Enquiries were made about purchasing the farm immediately to the north of East Craigs but by this time the Local Authority had zoned it for housing to accommodate the increasing demand for new housing in the City. Fortuitously, three farms owned by Gogarburn Hospital, Gogarbank, Overgogar and Roddinglaw became available as they were surplus to the Hospital's requirements. SASA initially took over Gogarbank and Overgogar farms (c. 1970) and merged them into one unit called Gogarbank Farm, although the farm HQ is actually based at Overgogar. Roddinglaw Farm, most of which lay to the north of the railway line was merged into Gogarbank Farm in about 1972 but the old Roddinglaw steading, and its associated farm workers houses, was sold privately. All three farms had been in permanent grassland since the Second World War and a lot of work was needed to restore, even out the fertility and improve the drainage to make them suitable for field trials. At the same time, some modifications were made to field boundaries in order to improve the regularity of field shapes. The fields on the west side of the farm had to be substantially reorganised when the M8 extension was built in the 1990s. The pressure on the Gogarbank farm land from encroachment of development from Edinburgh remains sustained.

OSTS and Crop Certification

Seed and planting stock of most agricultural and horticultural crops may only be marketed if certified. For true seed crops, certification involves a number of controls in addition to field approvals. This work began with the Official Seed Testing Station (OSTS). Certification of true seed crops and potatoes also involves field inspection and post control plots and there are extensive areas of training and control plots each year at Gogarbank Farm. Laboratory checks include varietal investigation, analytical purity, germination and other characteristics. The seed certification schemes now provide most of the samples entering the Official Seed Testing Station for Scotland at SASA. The Seed Potato Classification Scheme has evolved through several phases since its inception in 1918. For potatoes this process was taken to its logical conclusion in 1999, with the transfer of the staff responsible for the administration of the scheme to SASA.

Variety Testing

Variety Testing at SASA began at the very start in 1913 with varietal identification of potatoes in order to establish their susceptibility to potato wart disease. In 1965 the testing of new varieties for Distinctness Uniformity and Stability (DUS) was placed on a formal footing in the UK in support of national listing and/or plant breeders rights for the crops concerned. This started with cereals but quickly encompassed other crops particularly peas and potatoes. SASA continues to work in this area for vegetable crops and Potatoes and we now have Entrustment status from the Community Plant Variety Rights Office (CPVO) which is the (seeds/tubers) for large numbers of varieties from a range of crops and we are actively engaging in greater public access to these resources through the publication of online databases.

Molecular Techniques

SASA continued to keep pace with scientific developments with the creation of the Diagnostics and Molecular Biology (DMB) section in 1992. DMB continued the development of SASA's monoclonal antibody work and also introduced the development of DNA-based techniques, including those based on the polymerase chain reaction (PCR). SASA's molecular biology work has led to the development of improved methods for detection and identification of plant pathogens, and also to methods for the genetic fingerprinting of potato varieties. Its molecular biology diagnostic expertise has been successfully adapted to support its GM Inspectorate role, with PCR assays developed to detect specific GM DNA. This function was invaluable in SASA's monitoring of the Scottish sites of the Field Scale Evaluation trials of GM crops which took place across the UK, and will be used to monitor for the adventitious presence of GM material in imported seed stocks.
Wildlife Incident Investigation Scheme (WIIS)

Operation of the WIIS began in Scotland in 1972. The origins of the Scheme lie in concerns about the environmental effects of persistent organochlorine insecticides during the late 1960s. Since then the Scheme has evolved to encompass a wide range of animals including companion animals such as cats and dogs, all types of farm livestock, as well as wild birds, mammals and honey bees. It has also been developed to monitor acute toxic effects of most types of pesticides in current commercial use. As part of the surveillance role the data generated may act as a trigger in the continuing regulatory process controlling the approval status of pesticide formulations. A second purpose of the Scheme is to provide evidence of misuse or of deliberate abuse of pesticides that can be used by the Scottish Government or the police to enforce legislation relating to the safe use of pesticides and the protection of food, the environment and animals. Data from the Scheme is regularly published on the SASA and Chemicals Regulation Directorate (CRD) websites.

Pesticide Residue in Foodstuffs (PriF)

The Pesticides Branch has participated in the Government’s surveillance for pesticide residues in food since 1965. Initially this work was mainly targeted at areas of specific concern relation to the use of certain pesticides. In 1977 the Government’s Working Party on Pesticide Residues (WPPR) was established to organise and administer the surveillance programme with a remit to provide information on the incidence and levels of pesticides in the national diet and to ensure compliance with maximum residue limit (MRL) regulations. The WPPR published comprehensive reports detailing all the results annually.

In 2000, in order to involve a wider range of members of the public and independent experts to act in an advisory role to the Government departments administering the programme, the independent Pesticide Residues Committee (PRC) was formed. Each year the PRC published 4 Quarterly Reports and an Annual Report of the results from the surveillance programme. Further changes have since been made with the formation of the Expert Committee on Pesticide Residues in Food (PriF), which replaced the PRC, in 2011. The PriF carries out monitoring of both home produced and imported food for pesticide residues. The purpose of this monitoring is threefold:

- To back up the statutory approvals process for pesticides by checking that no unexpected residues are occurring in crops;
- To check that residues do not exceed the statutory maximum residue levels; and
- To check that human dietary intakes of residues in foods are within acceptable levels.

Pesticide Survey Unit (PSU)

The PSU collects information about pesticide use on a range of agricultural and horticultural crops. The first official records were collected by the Scottish Office Department of Agriculture and Fisheries for Scotland (DAFS) at East Craigs in 1974.

Whilst the range and frequency of surveys has changed over time the PSU has continued to collect these data to the current day, first for DAFS then SOAFD (Scottish Office Agriculture and Fisheries Department) then finally SASA. This has resulted in the accumulation of a 40 year continuous dataset of pesticide usage patterns on the major crops grown in Scotland. This work has been honed over the years and SASA has recently gained Official Statistics status for the figures generated by the survey team and is working towards National Statistics status. The work is actively placed into the public domain with written reports and more recently with the arable crops data being made available online through the Scopes (Scottish Pesticides) database.
Wildlife Forensics

In 2011, a new post was created to further extend the scope of the molecular biology laboratories and increase the contribution SASA makes to the fight against wildlife crime. The Wildlife DNA Forensic unit was established in collaboration with TRACE Wildlife Forensics Network to analyse animal DNA evidence recovered in the course of wildlife crime investigations. From blood smears and feathers through to powders and products that may include protected animal species – a range of different tests can be employed. These tests can be crucial in determining whether a crime has been committed, and in some cases can link a suspect to a specific crime scene via animal DNA profile matching. The Wildlife DNA Forensic unit has received hundreds of samples for analysis in wildlife crime investigations since 2011, and has contributed too many successful prosecutions.

Horticulture and Marketing Unit (HMU)

HMU was formed in the mid 1960s and brought together specialists with a background in horticulture to undertake inspection duties in relation to plant health, certification of plant propagating material and statutory grading for fruit and vegetables.

After the UK joined the European Community in 1972, the work of the unit broadened to accommodate European legislation and this has steadily evolved over the years to meet the current requirements we have today.

Following realignment of divisional functions with the Agriculture, Food and Rural Communities Directorate, HMU joined SASA in April 2013.

Plant Health, Horticulture, Seeds & Potatoes Policy

The policy team has existed with Scottish Government for many years, but in April 2018 the team joined SASA as a way to ensure policy worked closely with the science that is central to policy making.

The Future

The pace of technological advance has moved forward at an increasing speed over the past few years and our work methods of today bear little resemblance to those of 1925, but the results remain the same, our continued support of the agricultural industry and the environment in Scotland. Over the years SASA has been dynamic in its approach to what has fundamentally remained the same core activity namely the support of agriculture and the environment of the local production systems and has been a lead player in this work on an international stage.

The future will hold challenges and opportunities but whilst we continue to produce and consume food and value for environment SASA will have a vital role to play for our citizens.
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