

Annual Report

Fiscal Year 2020

Executive Summary

Fiscal Year 2020 was a great year for the NDSURF. In previous years the crops generating the most revenue for NDSURF were wheat, potatoes, and edible beans. This fiscal year, 'ND17009GT' soybean generated over 40% of the research fees received and helped propel NDSURF's revenue for FY2020 to over \$2.26M. More detailed information about the crop varieties generating revenue for NDSURF can be found in the sidebar on page 2 of this report.

Due to the impact of 'ND17009GT' on NDSURF's revenue and the retirement of Dr. Ted Helms (the NDSU soybean breeder for 34 years), this issue of the NDSURF Annual Report is dedicated to soybeans. Not only are soybeans an important part of the human diet and as a component of animal feed, but soybean oils and proteins have properties that make them excellent candidates as building blocks for manufactured goods.

FY2020 also saw the retirement of Dr. Ken Grafton from NDSU. Dr. Grafton held numerous roles at NDSU during his 40 years of distinguished service including: Dry Bean Breeder; Director of the ND Agricultural Experiment Station; Dean of the College of Agriculture, Food Systems and Natural Resources; VP of Agricultural Affairs; and Interim Provost. In addition, he was a member of the NDSURF Board of Directors. I would like to express my sincere appreciation to Dr. Grafton for his dedication to the Board and his guidance during my first three years with NDSURF.

NDSURF also welcomed Saurabhi Satam as the new Business Development and Licensing Associate in December of 2019. Ms. Satam is focused primarily on the technology portfolio.

Current indications are that FY2021 won't see quite the same level of revenue as FY2020, but we continue to be optimistic and look forward to working with our stakeholders into the future.

Jolynne

Jolynne R. Tschetter, Ph.D.
Executive Director

FY2020 AT A GLANCE

PLANT VARIETIES

Seven new agricultural varieties were released from NDSU in FY20.

'ND Gardner' winter rye*	'ND Dickey' conventional soybean*
'ND Dawn' yellow pea*	'ND Heart' conventional oat*
'ND Twilight' black bean	'ND Crown' chickpea*
'ND040341' naked oat.	

Varieties marked with an asterisk are either under license or a license is being negotiated with ND Crop Improvement and Seed Association. 'ND Twilight' is available to growers under individual non-exclusive licenses and 'ND04341' is a specialty oat with a unique flavor profile that has been exclusively licensed to Row 7.

While 'ND Crown' chickpea was released this past year, seed will not be available until the 2021 growing season.

Ten PVP applications were issued in FY2020 including:

'ND Hammond' flax	'ND VitPro' hard red spring wheat
'ND Riveland' durum	'ND Grano' durum
'ND Eagle' lentil	'ND Stutsman' soybean
'ND Benson' soybean	'ND17009GT' soybean
'ND Dylan' winter rye	'ND Palomino' slow darkening pinto bean

HORTICULTURE

The Hyland Splendor™ Mugo Pine is the newest addition to NDSU Research Foundation's horticulture portfolio. This beautiful Mugo Pine variety grows up to 15-18 feet in an upright pyramidal shape. Its foliage grows 1-2" long evergreen needles in pairs that persist for five or more years. Its uniqueness lies in the ability to maintain the superior dark green color even in winters. Hyland Splendor™ is currently available at Oregon Pride Nurseries.

NDSU Research Foundation was awarded two US registered trademarks this year for Fireflare Orange® Mollis Azalea and Summer Flare® Japanese Tree Lilac. One Canadian registered trademark was granted for Cinnamon Curls® Dwarf Korean Birch.



ISSUED PATENTS

Eight US Patents issued in FY20. Two patents cover a bio-derived composition for dust control for roads (details on next page). One patent describes a novel soybean oil derived specialty polymer formulation (details on next page).



Novel Monomers From Biomass depicts lignin or cellulose derived monomers that can be used to produce bio-polymers and bio-plastics. *Amphiphilic Siloxane-Polyurethane Fouling-Release Coatings and Uses Thereof* illustrates a functional marine coating with anti-bio-fouling properties. *Switchable Adhesion* describes a novel on-off adhesion mechanism that can be used for rigid surfaces such as walls, floors and ceilings. *Ankle Replacement Apparatus and Method* covers an improved design and material for total ankle replacements, offering numerous benefits to surgeons

and patients. And lastly, *Compound for Inhibition of Delta-5-Desaturase (D5D) and Treatment of Cancer and Inflammation* reports a novel approach to treating multiple cancer types by targeting a compound that is commonly over-expressed in tumors.

REVENUE GENERATING VARIETIES

Barley

Conlon
ND Genesis
Pinnacle

Durum

Alkabo
Carpio
Divide
Joppa
ND Grano
ND Riveland
Tioga

Edible Beans

Eclipse Black Bean
Lariat Pinto Bean
Maverick Pinto Bean
ND307 Pinto Bean
ND Palomino Pinto Bean
Rosie Light Red Kidney Bean
Stampede Pinto Bean
Talon Dark Red Kidney Bean

Oats

Beach
Newburg
Rockford
Taipan
Comet
Nugene
Souris
Forge Oats*

Potatoes

AC Peregrine Red
Dakota Crisp
Dakota Pearl
Dakota Rose
Dakota Ruby
Dakota Russet
Dakota Trailblazer
NorDonna
NorValley

Rye

ND Dylan

Soybeans

Ashtabula
Blue Horizon
ND Benson
ND Henson
ND Stutsman
ND17009GT
ND18008GT
Shyenne
Trall

Wheat

Barlow
Elgin ND
Faller
Glenn
Mott
ND VitPro
Prosper
Velva

*Forge oats are not available in the US due to susceptibility to crown rust races prevalent in the US.

SOYBEANS: AN IMPORTANT CROP FOR NORTH DAKOTA

Soybeans are an essential part of North Dakota Agriculture and contribute significantly to our state's economy. While the primary markets for soybeans are for use in animal feed and human consumption, soybeans are also being used to derive materials for a wide range of products. This section highlights some of the ways NDSU researchers are using soybeans to develop new technologies.

BIODEGRADABLE SOY-BASED PLASTICS

Dr. Long Jiang, Associate Professor in NDSU's Department of Mechanical Engineering, and his team have developed novel biodegradable plastics derived from soybean-based

proteins. This bio-plastic formulation is cost-effective, easy to manufacture, and an excellent alternative to traditional petroleum-based plastics. This new plastic can be used in small and large-scale manufacturing of everyday items of varying shapes and sizes such as cutlery, containers, packaging items, carpets, small medical devices as well as have agricultural use in seeding stripes, flower pots, mulching and irrigation systems, to name a few. Biodegradable or "Green" plastics have tremendous market potential,

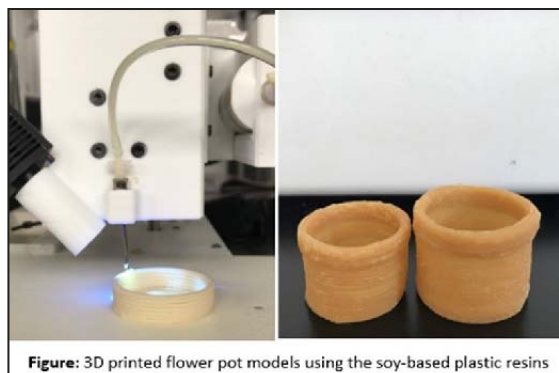


Figure: 3D printed flower pot models using the soy-based plastic resins

estimated to reach \$6.12 billion worldwide by 2023. We know this technology is a perfect fit for this market and are currently searching for potential partners for commercialization.

PLANT-BASED PROCESSING OILS FOR RUBBER COMPOUNDS

NDSU researchers have utilized soybean oil derivatives to develop a bio-based and eco-friendly alternative to conventional petroleum-based processing oils for rubber compounds. These oils are comparable to the currently available processing oils used by the industry and impart excellent traction on wet and icy surfaces. Additionally, they have proven to be non-toxic and provide tear resistance. This technology can be easily implemented into commonly used rubber processing mechanisms for use in manufacturing rubber goods. These oils are currently being tested by leading manufacturers in the tire industry to see if they can improve the durability of tires for passenger, recreational and/or commercial vehicles. This technology is currently patent-pending.

BIO-BASED COATINGS

Dr. Dean Webster, chair and professor in NDSU's Department of Coatings and Polymeric Materials, and his team have developed novel coatings derived from soybean oil. These bio-based coatings are colorless, transparent, and have a unique advantage over other bio-based coatings on the market due to their ease of application. These sustainable coatings are categorized as 'thermosets' (materials that strengthen when heat is applied) and exhibit excellent hardness and gloss. A potential commercial application for these coatings is as a component in industrial paints where they can provide desired surface tolerance without any loss of color or shine. This high performance, yet cost-competitive coating is subject to a US Patent and we are currently scouting for potential partners to take this technology to market.

NDSURF BOARD OF DIRECTORS FY2020

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Joel Honeyman, Director
Stephen Herrmann, Director

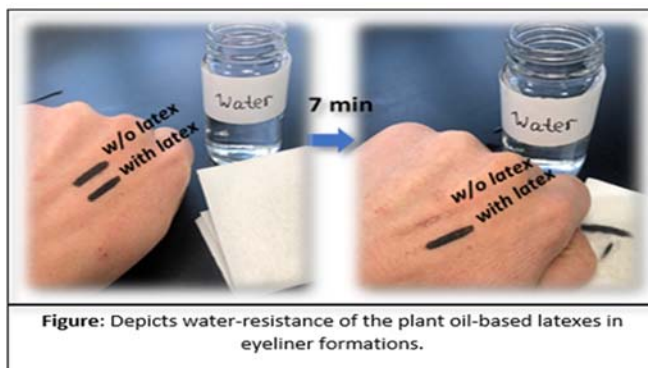
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BIO-BASED ACRYLIC MONOMERS AND POLYMERS

NDSU Research Foundation's patent application entitled *Bio-Based Acrylic Monomers and Polymers Thereof* was granted earlier this year. One of the promising technologies derived from soybean oil, these bio-based polymers came out of Dr. Voronov lab, who is an associate professor in NDSU's Department of Coatings and Polymeric Materials. These novel polymers

fall under the 'specialty polymers' category and can be used in the production of latexes, plastics, resins, adhesives, surfactants, and other products. This past year, Dr. Voronov's graduate student tested the properties of these polymers for applications in the cosmetic industry, as part of a NSF funded project. This project was a win for NDSU, the NDSU Research Foundation, and the private sector partner. Dr. Voronov strengthened his lab's relationship

with a prominent industry partner; Dr. Voronov's graduate student was able to gain valuable experience working in industry; the NDSU Research Foundation was able to identify a new industry segment to explore for this technology; and the company had the opportunity to work more closely with NDSU, establish a relationship with a promising researcher in a field of mutual interest, and had the opportunity to explore a new technology.



SOY-BASED ROAD DUST MITIGATION

There are approximately 1.3 million miles of unpaved roads in the US that generate fugitive road dust. This dust is hazardous to people, livestock and crops. However, the conventional methods used to suppress the road dust create environmental concerns, can be corrosive to vehicles and infrastructure, and have a tendency to wash off when roads are saturated with water. Researchers at NDSU recently developed novel polymers derived from bio-diesel waste and soy protein that can be applied to gravel roads to combat road dust. The novelty lies in water resistance and low corrosiveness as compared to existing dust suppressants. Additional benefits include stability, a non-hardening surface, and reproducible results in a variety of weather conditions. The original patent application was focused on the use of the soy-based product as a dust suppressant for gravel roads. A second benefit of the soy-based product became apparent during road testing when it was tested on a gravel road that included recycled asphalt as a component of the road bed. A continuation-in-part patent application entitled *Bio-derived Composition For Dust Control* was filed and granted this past year related to the polymers used as a conditioner for recycled asphalt roads.



NDSURF STAFF FY20

Jolynne R. Tschetter, Executive Director, Ph.D.
Saurabhi Satam, Business Development and Licensing Associate, M.S.
Denise Roehl, Business Coordinator

HORTICULTURAL VARIETIES CONTRIBUTING TO INCOME IN FY20

Dakota Goldcharm® Spirea

Dakota Goldrush® Potentilla

Dakota Sunspot® Potentilla

Prairie Gem® Flowering Pear

Prairie Spire® Green Ash

Dakota Pinnacle® Asian White Birch

Blueberry Delight® Juniper

Copper Curlys® Pekin Lilac

Northern Acclaim® Thornless Honey-locust

Prairie Dream® Paper Birch

Prairie Horizon® Manchurian Alder

Prairie Torch® Swiss Stone Pine

Prairie Statesman® Swiss Stone Pine

Prairie Expedition® American Elm

Prairie Stature® Hybrid Oak

Prairie Reflection® Laurel Willow

Spring Welcome® Magnolia

Northern Tribute® River Birch

Royal Splendor® Norway Spruce

Northern Herald® Eastern Redbud

Cinnamon Curlys® Dwarf Korean Birch

Northern Empress® Japanese Elm

NDSU Research Foundation
Statement of Financial Activities
July 2019 through June 2020

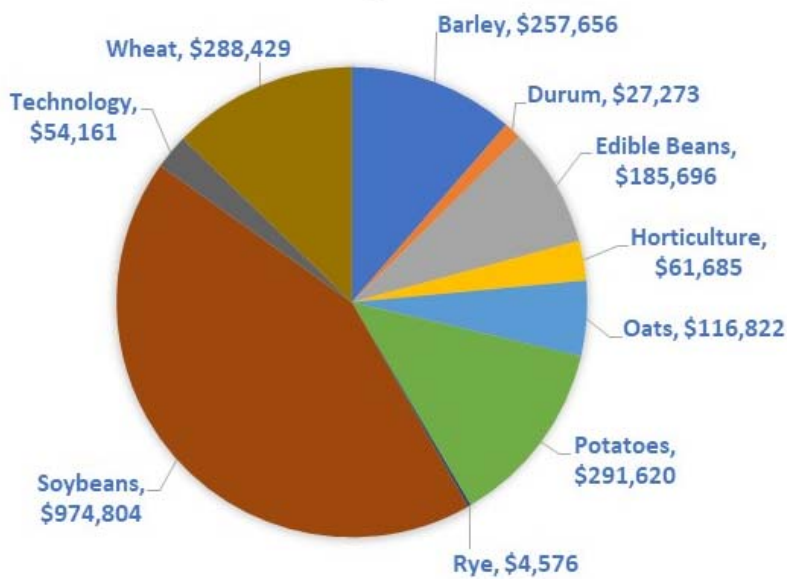
	Jul '19 - Jun 20
Ordinary Income/Expense	
Income	
Foundation	
Research Fee/Royalty Payments	2,262,766.07
Other Operating Income	
PVP Cost Reimbursement	19,290.00
Other Interest Income	5,390.22
Patent Cost Reimbursement	26,808.27
License Fees	10,200.00
Other Operating Income - Other	0.00
Total Other Operating Income	61,688.49
Foundation Interest Income	1,488.66
Total Foundation	2,325,943.22
Endowment	
ADHM Endow Inc.	8.93
Math Endow Inc.	7.55
CSM Endow Inc.	3.64
NDSU/RF Endow Income	53,592.87
Spring Wheat Endowment	74,405.03
Durum Endowment	32,247.06
Total Endowment	160,265.08
Total Income	2,486,208.30
Gross Profit	2,486,208.30
Expense	
Legal & Related Expenses	
Collection Legal Fees	434.98
Trademark Expenses	450.00
Patent Legal Fees	176,310.23
License Legal Fees	16,450.91
PVP Expenses	31,919.51
Legal & Related Expenses - Other	392.97
Total Legal & Related Expenses	225,958.60
Distributions	1,949,763.83
Administrative Expenses	272,510.98
Total Expense	2,448,233.41
Net Ordinary Income	37,974.89
Other Income/Expense	
Other Income	
Net Gain/Loss on Investments	
2D Endow Gain/Loss	126,670.47
2W Endow Gain/Loss	191,989.15
BSBT STL SUB Corp Bond Gain/Los	-366.01
BSBT Common Stock Gain/Loss	8,224.83
BSBT Fixed Gain/Loss	21,857.61
BSBT Mutual Fund Gain/Loss	13,653.68
Vanguard Gain/Loss	37,772.01
Total Net Gain/Loss on Investments	399,801.74
Total Other Income	399,801.74
Net Other Income	399,801.74
Net Income	437,776.63

NDSU Research Foundation Statement of Financial Position

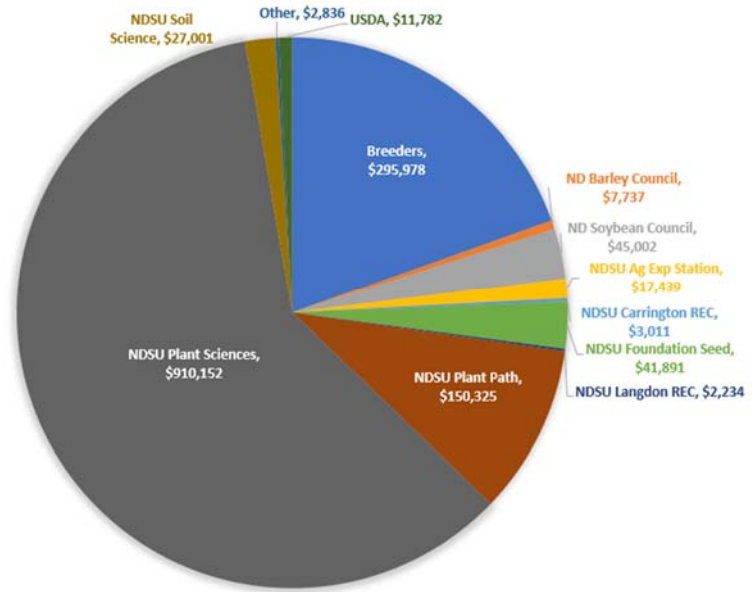
As of June 30, 2020

	Jun 30, 20
ASSETS	
Current Assets	
Checking/Savings	693,544.37
Other Current Assets	
Prepaid Expenses	9,220.80
Total Other Current Assets	9,220.80
Total Current Assets	702,765.17
Fixed Assets	
Office Equipment	19,339.63
Accum Depr - Office Equipment	-19,339.63
Total Fixed Assets	0.00
Other Assets	
(1) NDSU/RF Endowment	
RBC Wealth Management	
RBC Cash and Money Market	
Money Market	352,222.87
Total RBC Cash and Money Market	352,222.87
Total RBC Wealth Management	352,222.87
Bell State Bank & Trust	
BSBT STL SUB	324,396.56
BSBT RF Agency	1,165,883.28
Total Bell State Bank & Trust	1,490,279.84
Vanguard-S&P 500 Fund	740,085.65
Total (1) NDSU/RF Endowment	2,582,588.36
(3) Plant Sciences Endowment	
2D Endow Durum	2,162,568.04
2W Endow Spring Wheat	3,976,693.91
Total (3) Plant Sciences Endowment	6,139,261.95
(8) Math Endow	3,975.41
(9) College of Science and Math	7,610.23
(10) ADHM Endow	5,700.09
Total Other Assets	8,739,136.04
TOTAL ASSETS	9,441,901.21
LIABILITIES & EQUITY	
Liabilities	
Current Liabilities	
Accounts Payable	
Accounts Payable	3,707.66
Total Accounts Payable	3,707.66
Other Current Liabilities	
Accrued Payroll Expense	367.65
Total Other Current Liabilities	367.65
Total Current Liabilities	4,075.31
Total Liabilities	4,075.31
Equity	
Designated for Plant Science	
(2) PS Endowment 2W End	3,976,693.91
(3) PS Endowment 2DEnd	2,162,568.04
Total Designated for Plant Science	6,139,261.95
Designated for Endowment	
NDSU RF/Endowment	2,582,588.00
Total Designated for Endowment	2,582,588.00
Designated for ADHM	5,700.13
Designated for Math	3,975.41
Designated for Science & Math	1,933.09
Research Foundation	698,690.00
Retained Earnings	-432,099.31
Net Income	437,776.63
Total Equity	9,437,825.90
TOTAL LIABILITIES & EQUITY	9,441,901.21

FY20 ROYALTY/FEE INCOME



FY20 DISTRIBUTION OF AG FEES



FY20 DISTRIBUTION OF RESEARCH FEES

FY20 research fees and license revenues were distributed to the following entities:

Distribution Activity	Barley	Durum	Edible Beans	Endowment	Horticulture	Oats	Potato	Rye	Soybeans	Technology	Wheat	Grand Total
2D Endow Durum				250,000								250,000
2W Endow Wheat				120,000								120,000
Breeders	55,674	5,938	46,271		11,532	34,113	66,376	3,678			83,927	307,511
Inventors										14,475		14,475
ND Barley Council	7,737											7,737
ND Soybean Council									45,002			45,002
U MN Foundation #3830											89	89
USDA			11,782									11,782
VP RCA										3,006		3,006
University of Illinois									513			513
ND Ag. Experiment Station	4,697	577	4,265			909		457	13		6,522	17,439
NDSU Carrington REC			1					3,009				3,011
NDSU Coatings/Polymers										5,355		5,355
NDSU College of Engineering										1,718		1,718
NDSU Electrical & Computer										429		429
NDSU Entomology											76	76
NDSU Foundation Seed	3,939	577	2,759			909		184	27,001		6,522	41,891
NDSU Industrial & Mfg Eng										1,288		1,288
NDSU Langdon REC							2,234					2,234
NDSU Physics										1,825		1,825
NDSU Plant Pathology	14,557	577	10,705				55,244		54,099		15,143	150,325
NDSU Plant Sciences	88,343	7,883	44,603		26,906	39,654	74,091		629,477		26,100	937,058
NDSU Soil Science									27,001			27,001
Grand Total	174,94	15,552	120,385	370,000	38,438	75,585	197,946	7,329	783,105	28,097	138,380	1,949,764