**Appendix 1: Survey questionnaire.**

**SECTION 1 FARM BACKGROUND**

**Q1** In what state and county do you farm? Please select your state and type your county.

Montana; South Dakota

**Q2** How many years have you farmed?

Less than 1 year; Between 1 year and 5 years; Between 5 years and 10 years; Over 10 years

**Q3** What is the size of your farm?

Less than 1 acre; Greater than 1 acre and less than 5 acres; Greater than 5 acres and less than 10 acres; Greater than 10 acres and less than 100 acres; Greater than 100 acres and less than 1,000 acres; Greater than 1,000 acres

**Q4** What is the approximate contribution of on-farm income (from sales of crops or livestock) to your overall income?

Less than 10%; Between 10% and 20%; Between 21% and 50%; Between 51% and 75%; Over 75%

**Q5** Do you own, lease, or are hired on the land you farm on?

I own the land; I lease the land; I am employed as a farm worker; Other, please explain

**Q6** How many people work on your farm (including yourself)?

1 – 3; 4 – 10; 11 – 20; Over 20

**SECTION 2 EFFECTS OF THE COVID-19 PANDEMIC ON FARM MANAGEMENT, FARM ECONOMY, AND FOOD SYSTEMS**

**Q7** Are you concerned with how the COVID-19 pandemic will impact your farming?

Response options Q7-11: Yes, please explain; No, please explain

**Q8** Are you concerned with how the COVID-19 pandemic will impact your diet?

**Q9** Are you concerned with how the COVID-19 pandemic will impact your community's food security?

**Q10** Have you experienced a change in your household income because of the COVID-19 pandemic?

**Q11** With regard to farming, has your overall anxiety changed because of the COVID-19 pandemic?

**Q12** As a result of the COVID-19 pandemic, have you experienced any of the following changes? Please select all that apply and briefly list what has changed.

What you are growing this season, please specify; What you will grow post 2020 growing season, please specify; Farming practices, please specify; Access to different types of food, please specify; Food prices, please specify; Access to inputs, such as seeds or fertilizers, please specify; Price of commodities grown/raised, please specify; Household income related to your farming operation, please specify; Availability of farm labor, please specify

**Q13** Do you think that the diversity on your farm has impacted your ability to respond to the COVID-19 pandemic?

**Q14** Not processed in this article.

**SECTION 3 FARM MANAGEMENT AND CROP DIVERSITY**

**Q15** Do you practice any of the following on your farm? *Check all that apply.*

Application of biochar; Application of compost; Application of compost teas; Application of manure; Conservation tillage; Cover crops; Crop rotations; "Homegrown" (growing by organic standards and selling locally in your state); Inter-cropping; Mulching; No-tillage; Organic agriculture (certified or not); Pasture cropping; Tillage; None of the above; Other, please explain briefly

**Q16** Do you practice any of the following on your farm? *Check all that apply.*

Conserving natural areas in the landscapes around the farm; Growing multiple types (varieties) of the same crop; Holistically managed grazing; Incorporating livestock or aquaculture on farm; Integrated pest management; Maintaining hedgerows; Maintaining multiple breeds of specific livestock species on farm; Maintaining riparian buffers; Maintaining trees on farm / agroforestry; Part of a producer cooperative; Planting multiple types of crops in a single field; Pollinator strips; Processing crops into different products; Renewable energy use; Seed exchange; Seed saving; Silvopasture; Water saving; None of the above; Other, please explain

**Q17** What are all of the **food crops** you grow on your farm? Please list species/types and varieties.

**Q18** What are all the **animals you raise** on your farm? Please list type of animal and its breed.

**Q19&20** Not processed in this article.

**SECTION 4 DIVERSIFIED FARMING**

**Q21-26** Not processed in this article.

**SECTION 5 FOOD SYSTEM RESILIENCE AND VULNERABILITY**

**Q27** Have you had to change your farming practices because of any of the following factors? *Check all that apply.*

Policies; Markets, Subsidies; Climate factors; Land-use change; The COVID-19 pandemic

**Q28** What is the main intended destination of your agricultural production? (Question adapted from FAO Analytical Framework on Agroecology)

Producing primarily for sale (selling 90% or more); Producing mainly for sale, with some own consumption (selling more than 50% and up to 90%); Producing mainly for own consumption, with some sales (selling more than 10% and up to 50%); Producing primarily for own consumption (selling 10% or less) (4)

**Q29** Not processed in this article.

**Q30** With regard to your food situation, was the following statement often true, sometimes true, or never true for (you/your household) in the last 12 months? "We worried whether (my/our) food would run out before (I/we) got money to buy more."

Often true; Sometimes true; Never true

**Q31** With regard for your food situation, was the following statement often true, sometimes true, or never true for (you/your household) in the last 12 months? "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more."

Often true; Sometimes true; Never true

**Appendix 2: Surveyed farmers per farm size.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Farm size** | **Farm < 100 acres** | **Farm > 100 acres** | **Total** |
| **Farm location** | | | |
| Montana | 19 | 12 | 31 |
| South Dakota | 4 | 19 | 23 |
| **Contribution of farming to household income** | | | |
| Farming < 75% of income | 16\* | 15\* | 31 |
| Farming > 75% of income | 6 | 14\* | 20 |
| **Contribution of farming to household food security** | | | |
| >90% of production for sale | 7\* | 18\*\*\* | 25 |
| 50-90% of production for sale | 10\* | 6\*\*\* | 16 |
| <50% of production for sale | 5\* | 3\*\*\* | 8 |

\* No response (NR) = 1, \*\* NR = 2, \*\*\* NR = 3

**Appendix 3: Surveyed farmers per farming expertise.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Farming expertise**  **(at current farm)** | **< 1 year** | **1-5 years** | **> 5 years** | **Total** |
| **Farm location** | | | | |
| Montana | 6 | 9 | 16 | 31 |
| South Dakota | 2 | 1 | 19 | 22 |
| **Farm size** | | | | |
| Farm > 100 acres | 2 | 2 | 26 | 30 |
| Farm < 100 acres | 6 | 8 | 9 | 23 |
| **Contribution of farming to household income** | | | | |
| Farming <75% of income | 7\* | 5 | 19\* | 31 |
| Farming >75% of income | 0\* | 5 | 15\* | 20 |
| **Contribution of farming to household food security** | | | | |
| >90% of production for sale | 4\* | 1\* | 20\*\* | 25 |
| 50-90% of production for sale | 2\* | 6\* | 8\*\* | 16 |
| <50% of production for sale | 1\* | 2\* | 5\*\* | 8 |

\* No response (NR) = 1, \*\* NR = 2

**Appendix 4: Crops and livestock produced on surveyed farms (as percentage of all farms).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Commodity** | Wheat | Corn | Oats | Rye | Sorghum |  |
| **% of farms** | 29.8 | 36.2 | 17.0 | 8.5 | 4.3 |  |
| **Commodity** | Pea/Bean | Lentil | Chickpea | Soybean | Alfalfa |  |
| **% of farms** | 17 | 8.5 | 4.3 | 17.0 | 4.3 |  |
| **Commodity** | Mustard | Onions/garlic | Potatoes | Hemp | Other field crops | Hay |
| **% of farms** | 2.1 | 6.4 | 8.5 | 2.1 | 6.4 | 2.1 |
| **Commodity** | Diverse vegetables | Diverse herbs\* | Berries | Perennial fruits | Mushrooms | Ornamentals |
| **% of farms** | 38.3 | 12.8 | 19.1 | 14.9 | 2.1 | 2.1 |
| **Commodity** | Cattle | Goats & Sheep | Hogs | Chicken | Ducks & Geese | Other animals |
| **% of farms** | 8.5 | 8.5 | 4.3 | 8.3 | 6.4 | 6.4 |

\*Spices and medicinal

**Appendix 5: Impact of farming expertise on pandemic perception.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Perceived impact of COVID-19 on** | **Impact of pandemic perceived** | | | | **No impact of pandemic perceived** | | | | **Significance** | |
| n (%) | < 1 year | 1 – 5 years | >5 years | n (%) | < 1 year | 1 – 5 years | >5 years | Cramer's V  Coefficient | p |
| **Future of farming** | **43 (81%)** | 8 | 8 | 27 | **10 (19%)** | 0 | 2 | 8 | 0.2b | 0.3 |
| **Diet** | **8 (15%)** | 2 | 1 | 5 | **45 (85%)** | 6 | 9 | 30 | 0.12c | 0.81 |
| **Community food security** | **33 (62%)** | 4 | 6 | 23 | **20 (38%)** | 4 | 4 | 12 | 0.12c | 0.7 |
| **Farm income** | **33 (62%)** | 6 | 5 | 22 | **20 (38%)** | 2 | 5 | 13 | 0.15c | 0.9 |
| **Anxiety** | **25 (47%)** | 4 | 5 | 16 | **28 (53%)** | 4 | 5 | 19 | 0.04c | 0.77 |
| **Crops present season** | **19 (43%)** | 3 | 6 | 10 | **25 (57%)** | 2 | 2 | 21 | **0.35a** | **0.02** |
| **Crops next season** | **11 (25%)** | 2 | 3 | 6 | **33 (75%)** | 3 | 5 | 25 | 0.20b | 0.18 |
| **Crop management** | **14 (32%)** | 4 | 5 | 5 | **30 (68%)** | 1 | 3 | 26 | **0.53a** | **0.01** |
| **Total household income** | **20 (45%)** | 3 | 3 | 14 | **24 (55%)** | 2 | 5 | 17 | 0.12c | 0.95 |
| **Farm labor** | **15 (34%)** | 2 | 3 | 10 | **29 (66%)** | 3 | 5 | 21 | 0.06 c | 0.69 |

a Strong relationship b Moderate relationship c Weak relationship

**Appendix 6: Impact of farm size on pandemic perception**.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Perceived impact of COVID-19 on** | **Impact of pandemic perceived** | | | **No impact of pandemic perceived** | | | **Significance** | |
| **n (%)** | **≤ 100 acres** | **> 100**  **acres** | **n (%)** | **≤100 acres** | **> 100**  **acres** | **Cramer's V**  **Coefficient** | **p** |
| **Future of farming** | **43 (81%)** | 34 | 9 | **10 (19%)** | 6 | 4 | 0.17 c | 0.2 |
| **Diet** | **8 (15%)** | 4 | 4 | **45 (85%)** | 36 | 9 | 0.25b | 0.07 |
| **Community food security** | **33 (62%)** | 25 | 8 | **20 (38%)** | 15 | 5 | 0.01c | 0.99 |
| **Farm income** | **33 (62%)** | 27 | 6 | **20 (38%)** | 13 | 7 | 0.19c | 0.17 |
| **Anxiety** | **25 (47%)** | 20 | 5 | **28 (53%)** | 20 | 8 | 0.1c | 0.47 |
| **Crops present season** | **19 (43%)** | 12 | 7 | **25 (57%)** | 21 | 4 | 0.24b | 0.11 |
| **Crops next season** | **11 (25%)** | 6 | 5 | **33 (75%)** | 27 | 6 | 0.27b | 0.16 |
| **Crop management** | **14 (32%)** | 10 | 4 | **30 (68%)** | 23 | 7 | 0.06c | 0.7 |
| **Household income** | **20 (45%)** | 15 | 5 | **24 (55%)** | 18 | 6 | 1.0c | 0.99 |
| **Farm labor** | **15 (34%)** | 7 | 8 | **29 (66%)** | 26 | 3 | **0.47a** | **0.01** |

a Strong relationship b Moderate relationship c Weak relationship

**Appendix 7: Impact of household economy on pandemic perception.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Perceived impact of COVID-19 on** | **Impact of pandemic perceived** | | | **No impact of pandemic perceived** | | | **Significance** | |
| **Responses**  **n (%)** | **≤75% of total economy** | **> 75% of total economy** | **Responses**  **n (%)** | **≤75% of total economy** | **> 75% of total economy** | **Cramer's V**  **Coefficient** | **p** |
| **Future of farming** | **43 (81%)** | 28 | 15 | **10 (19%)** | 7 | 3 | 0.04c | 0.77 |
| **Diet** | **8 (15%)** | 2 | 6 | **45 (85%)** | 33 | 12 | **0.37a** | **0.01** |
| **Community food security** | **33 (62%)** | 21 | 12 | **20 (38%)** | 14 | 6 | 0.07c | 0.64 |
| **Farm income** | **33 (62%)** | 22 | 11 | **20 (38%)** | 13 | 7 | 0.02c | 0.9 |
| **Anxiety** | **25 (47%)** | 17 | 8 | **28 (53%)** | 18 | 10 | 0.04c | 0.78 |
| **Crops present season** | **19 (43%)** | 11 | 8 | **25 (57%)** | 18 | 8 | 0.15c | 0.33 |
| **Crops next season** | **11 (25%)** | 5 | 6 | **33 (75%)** | 24 | 9 | 0.25b | 0.09 |
| **Crop management** | **14 (32%)** | 10 | 4 | **30 (68%)** | 19 | 11 | 0.08c | 0.6 |
| **Household income** | **20 (45%)** | 9 | 11 | **24 (55%)** | 20 | 4 | 0.4a | 0.01 |
| **Farm labor** | **15 (34%)** | 9 | 6 | **29 (66%)** | 20 | 9 | 0.09c | 0.56 |

a Strong relationship b Moderate relationship c Weak relationship