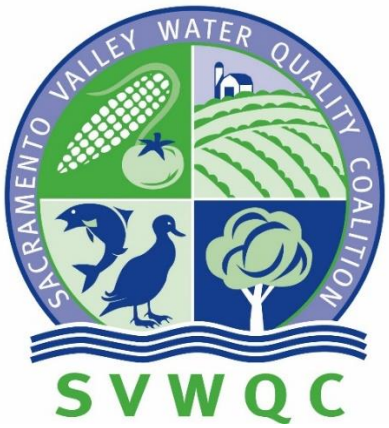

Sacramento Valley Water Quality Coalition

Annual Management Practice Implementation and Nitrogen Management Report

2021 Crop Year

Prepared for

Central Valley Regional Water Quality Control Board

Prepared by

LAND IQ

NOVEMBER 2022

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LIST OF ACRONYMS

A	**N Applied**
A/R	**Ratio of Nitrogen Applied to Nitrogen Removed**
A/Y	**Ratio of Nitrogen Applied to Yield**
A-R	**Nitrogen Applied Minus Nitrogen Removed**
ANOVA	**One-Way Analysis of Variance**
AUM	**Animal Unit Month**
CV	**Coefficient of Variation**
CY	**Crop Year**
FE	**Farm Evaluation**
GAR	**Groundwater Quality Assessment Report**
GQMP	**Groundwater Quality Management Plan**
HVA	**High Vulnerability Area**
INMP	**Irrigation and Nitrogen Management Plan**
LTILRP	**Long-Term Irrigated Lands Regulatory Program**
MC	**Medcouple Statistic**
MPIR	**Management Practice Implementation Report**
MRP	**Monitoring and Reporting Program**
MU	**Management Unit**
N	**Nitrogen**
NCWA	**Northern California Water Association**
NR	**Not Reported**
PLSS	**Public Land Survey System**
R	**Nitrogen Removed**
RWQCB	**Regional Water Quality Control Board**
SSURGO	**Soil Survey Geographic Database**
SQMP	**Surface Water Quality Management Plan**
SVWQC	**Sacramento Valley Water Quality Coalition**
WDRs	**Waste Discharge Requirements**

EXECUTIVE SUMMARY

Subwatersheds within the Sacramento Valley Water Quality Coalition (Coalition) collected Irrigation and Nitrogen Management Plan (INMP) Summary Reports for the 2021 crop year (CY) that were filled out by Coalition members.

The individual Coalition subwatersheds (Subwatersheds) assembled member data and submitted aggregated data for further analysis. The data were reviewed and checked for errors and omissions, and members were contacted to correct any noticeable errors. While a significant effort was made to correct all errors, some errors may have gone undetected. The 2021 CY INMP return rate was approximately 97% of members, with 5,867 members reporting on 24,072 fields and 1,091,248 acres. The return rate was similar to the 2020 CY (94%) and the 2019 CY (97%). 2021 CY INMP data that was not reported consisted of 191 members, 532 fields, and 15,896 acres.

Late INMP data for the 2020 CY has continued to be submitted to the Coalition and as of November 5, 2022, there were 38 outstanding INMP summary reports. The late 2020 CY INMP data was submitted primarily via paper forms, so it is not available electronically and would require the Coalition a significant amount of time to digitize. Farm Evaluation (FE) data for the 2020 CY was submitted with the Coalition's 2021 INMP Summary Report, and FE data is not required to be collected again until 2026 for the 2025 CY.

This was the first year that three-year (3-yr) ratios were calculated for A/R using INMP data from the 2019, 2020, and 2021 CYs. Prior to the 2020 CY, only high vulnerability areas (HVAs) had to report INMP data, so most of the low vulnerability areas only had 2 years of data and were not eligible for 3-yr ratios. In addition, field level tracking was not implemented until the 2020 CY, so some fields from the 2019 CY could not be reliably tied to 2020 or 2021. To be eligible for the 3-yr ratios, a field had to have the following all 3 years:

- Same membership
- Same field ID
- Same crop type
- Orchard at full production age (nitrogen removed (R) rates are not comparable between young and mature orchards)
- Not flagged for zero yield, questionable or exempt data

For annual crops, this would have resulted in a very small pool of 3-yr eligible fields because annual crop fields are often rotated between different crops. For example, sunflower is one of the highest acreage annual crops in the Coalition, but there were only 5 sunflower fields that met the above criteria. Thus, for annuals a different outlier method was developed. Annual crop fields had to be outliers in the 2021 CY and at least one of the two previous years (for any crop) using single year A/R ratios. For perennial crops, 3-yr A/R ratios were used, which required the field to have the same crop and be at full production age for all 3 years.

For both the annual and perennial crops, the outlier thresholds were calculated the same way using pooled 1-year A/R ratios from CY 2019 through 2021 to provide a larger sample size than if only fields with 3-yr ratios or single-year ratios for 2021 were used. The multi-year outlier thresholds were then compared to 3-yr ratios for perennial crops to identify 3-yr outliers and the 2019 – 2021 single year ratios for annual crops to identify fields that were outliers in 2021 and one or more prior years.

A/R and A-R summary statistics were summarized by crop type and included the following: mean, standard deviation, histogram plots, box and whisker plots, and high outliers. The outlier status and AR results will be provided in individualized feedback reports to each member as part of the Coalition's education and outreach program. There were 18 annual crop fields that were considered outliers and 45 perennial crop fields considered outliers.

The statistical analysis of A/R by soil drainage class and irrigation method found some significant effects, but the analyses had lower reliability in crops with a small number of observations in certain classes. Soil drainage class did not appear to have a consistent effect on A/R as the drainage class with the highest A/R varied by crop. Every drainage class except for "poorly drained" had the highest mean A/R for at least one crop. Irrigation method may have influenced A/R in some crops, but overall, there was not a clear trend and many irrigation methods had less than 10 observations. Several annual crops had lower A/R with drip irrigation compared to flood or furrow, but some annual crops had the opposite effect. For perennials, walnuts had slightly lower A/R for drip, micro-sprinkler, and sprinkler compared to flood or furrow, but this pattern was not seen for any of the other perennials.

1 INTRODUCTION

The Central Valley Regional Water Quality Control Board (RWQCB) developed the Long-Term Irrigated Lands Regulatory Program (LTILRP) to address surface water quality and to add groundwater quality monitoring and reporting requirements for agricultural irrigated land. The requirements were adopted as Waste Discharge Requirements (WDRs) with an associated Monitoring and Reporting Program (MRP) (General Order No. R5-2014-0030-R1).

The Sacramento River Watershed WDRs for members of the Sacramento Valley Water Quality Coalition (Coalition) require all members to prepare an Irrigation and Nitrogen Management Plan (INMP) annually, and update Farm Evaluations (FE) every five years. The WDRs require the Coalition to submit an INMP Summary Report for the previous crop year (CY) and to submit FE data from the most recent FE in Excel workbook format annually. The Coalition is also required to submit a Management Practice Implementation Report (MPIR) annually in Excel workbook format.

This Annual Management Practice Implementation and Nitrogen Management Report includes the INMP Summary Report evaluation (Annual Report Components 19 in the WDRs), the requirements of which are summarized in Table 1. For INMP, the Coalition is required to summarize member INMP data, including comparisons of the ratio of nitrogen (N) applied to N removed (A/R) and the difference between N applied and N removed (A-R) by crop type for single year and three-year (3-yr) intervals. These statistical comparisons are provided in Appendix A. This is the first year that comparisons were made for a 3-yr interval using data from the 2019 – 2021 CY. The 2019 CY data only covers fields located in high vulnerability areas (HVAs) identified the Coalition's 2014 Groundwater Quality Assessment Report (GAR) (CH2M Hill, 2014; CH2M Hill, 2016). Fields in low vulnerability areas did not begin reporting until the 2020 CY. The Coalition will report back to each member, separate from this report, A/R and A-R estimates for each of the member's parcels compared to other members with the same crop in the Coalition. An example of this report is provided in Appendix B. Management practice data from the INMP surveys are provided in Excel workbook format in Attachments 1 and 2, as required in the Order.

Late INMP data for the 2020 CY has continued to be submitted to the Coalition and as of November 5, 2022, there were 38 outstanding INMP summary reports. The late 2020 CY INMP data was submitted primarily via paper forms, so it is not available electronically and would require the Coalition a significant amount of time to digitize.

The Coalition collected FE data for the 2020 CY and will not have to complete FE surveys again until the 2025 CY. The data received from the 2020 CY FEs is provided in Attachment 1 by township, as required in the Order and a subsequent letter from the RWQCB, sent on December 27, 2021.

The Coalition collected MPIR data for the 2020 CY and submitted an Excel spreadsheet with the November 2021 Annual Management Practices Report (SVWQC, 2021). Per the RWQCB letter sent on August 26, 2021, the groundwater portion of the MPIR spreadsheet should be submitted every third year beginning in 2021; thus, the next GW MPIR data will be submitted in 2024 for the 2023 CY. The

surface water MPIR data for Ulatis Creek is provided in Attachment 1. There was no data collected for Gilsizer Slough since the Surface Water Management Plan was deemed complete in the RWQCB letter sent on July 7, 2022.

In summary, this report includes the following components:

- INMP Summary Report Evaluation
- Summary of Annual Management Practice Information (INMP and MPIR)
- Annual Management Practice Implementation Data in Excel workbook format (Attachment 1)
- Annual Irrigation and Nitrogen Management Plan Summary Report Data in Excel workbook format (Attachment 2)

Table 1. Summary of Order requirements for Annual Report Components 19 and 20.

Summary of Requirements for INMP (Report Component No. 19)
Evaluation of A/R and A-R ratios by crop type
Evaluation of A/R and A-R by irrigation method, soil conditions, and farming operation size for each crop type
Evaluation of A/R 1-yr and A/R 3-yr differences by crop type
Provide mean, standard deviation, histogram plot, and box and whisker plot for A/R and A-R for each crop type
Provide a quality assessment of the collected information (e.g. missing data, potentially incorrect/inaccurate reporting) and a description of corrective actions to be taken
Summary of Requirements for Management Practice Information (Report Component No. 20)
Aggregate and summarize FE data by township
Provide a quality assessment of the collected information by township (e.g. missing data, potentially incorrect/inaccurate reporting) and a description of corrective actions to be taken

2 BACKGROUND

The area covered by the Coalition's WDRs encompasses all the Sacramento River Watershed. The Coalition is operated as a partnership with 12 local subwatersheds (Subwatersheds) coordinated by the Northern California Water Association (NCWA) (Figure 1). The Subwatersheds provide leadership for grower outreach and education about the importance of implementing practices protective of surface and groundwater quality, while NCWA, the third-party recognized by the RWQCB, manages development and implementation of surface water monitoring, annual reporting, and other Coalition deliverables, such as this report. Irrigated agriculture of the Coalition extends over 1.3 million acres, roughly 8% of the Sacramento River Watershed (excluding rice, which is covered under a separate

RWQCB order). The remaining approximate 92 percent of the Sacramento River Watershed consists of open space, riparian vegetation, and urban development.

The Coalition's low vulnerability areas for threat to groundwater quality from nitrates, as identified in the 2016 Groundwater Quality Assessment Report (GAR) (CH2M Hill, 2016) did not have to begin reporting INMP data until the 2020 CY. Several of the subwatersheds have no HVAs and reported INMP for the first time for the 2020 CY. The low vulnerability areas do not have enough years of data to calculate 3-yr A/R ratios.

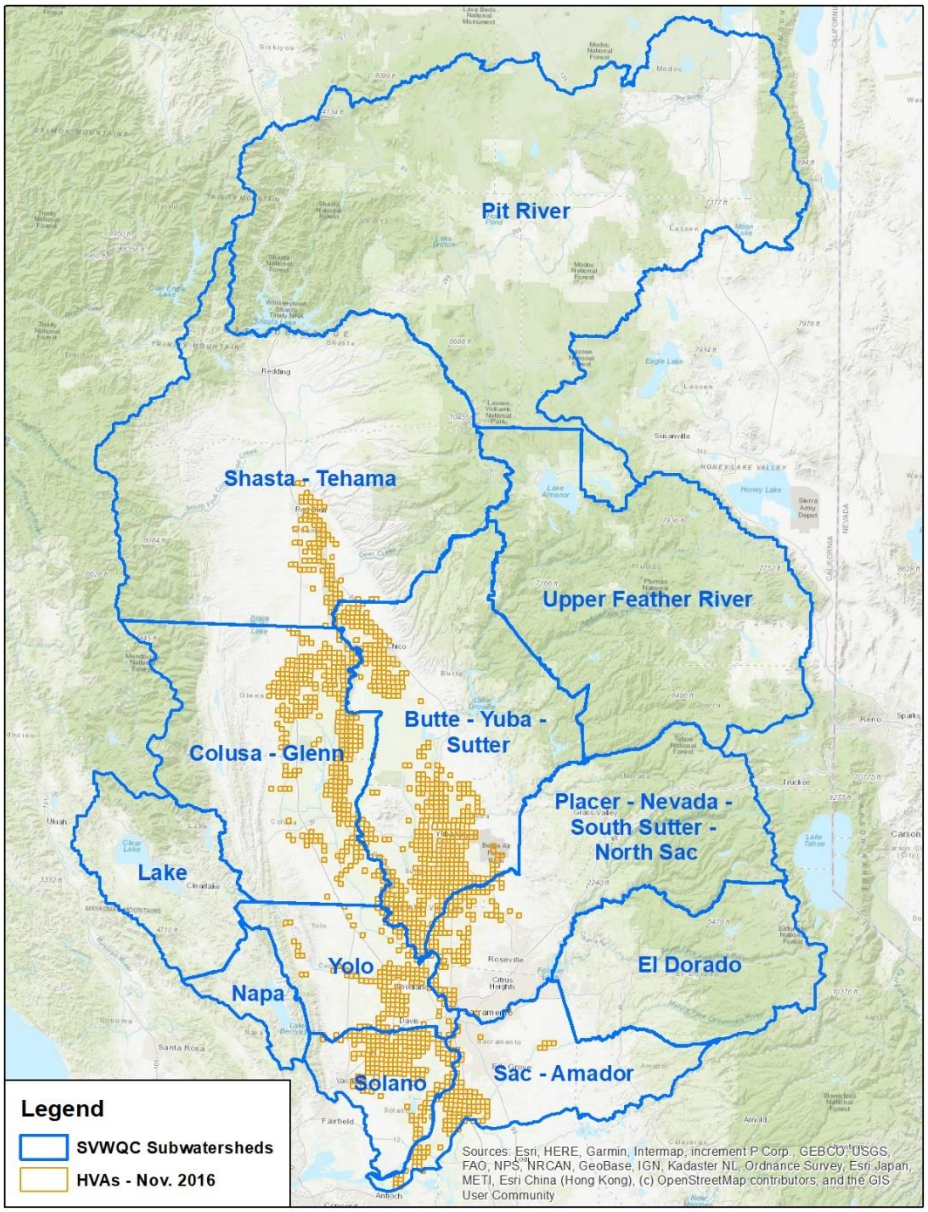


Figure 1. Subwatersheds and HVAs within Coalition.

3 FARM EVALUATION

The FE data for the 2020 CY was included in the November 2021 Annual Management Practices Report (SVWQC, 2021). As of the 2021 report, 94% of members had completed FE surveys. The return rate, whole farm evaluation (Section 1), and sediment and erosion control practices (Section 3) for the 2021 report are provided by township in Attachment 1, as required by correspondence from the RWQCB sent on December 27, 2021 and January 25, 2022. If a member's fields reported under Section 3 occur in multiple townships, the whole farm evaluation responses are duplicated across each township a member has fields in. The wells section (Section 2) of the approved FE template does not specify the parcel or field that the wells are located on, so this information cannot be linked to a township.

4 INMP SUMMARY REPORT EVALUATION

This section of the report summarizes the INMP Summary Report evaluation. The initial steps included data collection, quality assessment, and clean-up. Following collection and clean-up of the INMP data, any remaining fields with questionable values were excluded from the statistical analysis. After exclusion of questionable data, single-year and multi-year AR ratios (A/R and A-R) were calculated, and the data was joined to county parcel shapefiles to determine spatial information. The data was then evaluated for A/R outliers for each crop type, and the effect of soil and irrigation method on A/R was evaluated.

4.1 SUMMARY OF MEMBER DATA COLLECTION

On the INMP Summary Reports, members report irrigation and N data for each field, including crop, irrigated acres, N applied (A), yield (Y), planting year, irrigation method, and efficiency practices utilized for irrigation and N. Most members use an online reporting system. Members submitted INMP Summary Reports to the Subwatershed in which their fields are located, which were then exported to a spreadsheet, if collected online, or manually entered into a standardized MS Excel template if collected via paper form.

The completion statistics for the 2021 CY INMP Summary Reports are shown in Table 2. INMP data was received for 24,072 fields representing 5,867 members and 1,091,248 acres. INMP data that was not reported consisted of 532 fields, 191 members, and 15,896 acres. The overall member completion percentage of INMP Summary Reports for the 2021 CY was 97% which was slightly higher than the 2020 CY (94%) and the same as the 2019 CY (97%). Additional reports have since been received after the cut-off date for inclusion in the analysis, and the Coalition is continuing to work to obtain the remaining outstanding reports.

Table 2. Status of INMP summary reports received.

INMP Submission Status	Members[a]	Fields	Acres[b]
Not Submitted	191 (3%)	532 (2%)	15,896 (1%)
Submitted	5,867 (97%)	24,072 (98%)	1,091,248 (99%)

Notes:

a. A member can be included in both the submitted and not submitted count if they did not report on all their required fields.
b. The acreage for reports not submitted is based on prior years' irrigated acreage.

4.2 Summary of Member Data Quality Evaluation

The Coalition initially checked all returned forms for completeness and flagged any potential errors. Any INMP data flagged during the review process was sent to the applicable Subwatershed for follow-up with the member. Common errors identified during the review process and corrections applied included:

1. Incomplete reporting of all information required on the INMP Summary Report template or reporting multiple values for yield and N applied within a single field.
2. Amount of N fertilizer applied per acre was greater than 450 lbs/acre, which is the maximum realistic value for the crops grown within the Coalition. This could have been the result of a transcription error, reporting total fertilizer applied versus the percent of N in the fertilizer, total N applied for the field instead of per acre, or total N for compost instead of plant available N for the crop year. If total N was reported for compost, it was estimated that 1% of the reported value would be plant available if not specified by the member (Geisseler et al., 2021).
3. Production unit was not correct (e.g., tons was listed when the actual unit was lbs) or was provided on a volume basis rather than a mass basis (e.g., number of trees, cut flowers, square feet of turf, etc.). Corrections from volume to mass basis were made where possible based on typical values for the crop type (Table 3).
4. Yield was much higher or lower than the typical range of values for the given crop, as shown in Appendix C. The high yield flags were typically the result of either a transcription error, failure to convert yield units to pounds (lbs), or using total yield instead of per acre values. The low yield flags could be legitimate if there was crop failure, less harvests than normal (i.e., alfalfa with one cutting), or they could indicate an error in the crop type reported such as seed crops that were not marked as such.
5. Yield was reported on a different basis than the typical standard for the crop. For example, prune yields are typically reported on a dry basis, but some members may have reported on a wet basis. Nut crops can also be reported as gross weight, in-shell weight, or kernel/meat weight. The Coalition requested that members indicate the yield basis if different than the standard on their INMP Summary Reports, but some members did not fill this out or entered an incorrect basis. All reported yields were converted, where possible, to the typical standard

reporting basis for the crops listed in Table 4. If the yield basis conversion resulted in a more unreasonable yield value than the originally reported yield, the original value was kept.

6. The planting year or crop age did not make sense with the reported yield (i.e. a young orchard with a high yield).
7. Member reported APN did not have a matching APN in the corresponding county GIS parcel database. These discrepancies typically occurred because of a transcription error or in some cases because the parcel had been redrawn but had not been updated within the county GIS shapefile.
8. Member reported field ID or account ID, which is used to track fields over time, had a typo or did not match the format used in prior years for subwatersheds reporting via paper forms.

For members reporting online, corrections were made through the webtool by either the member or Subwatershed staff. After the initial data flagging and review period, the dataset was reviewed a final time. The final dataset included some late submissions that were not captured during the initial review.

Table 3. Estimated yield unit weights for conversion from volumetric units.

Crop	Volumetric Yield Unit	Estimated Yield Unit Weight
Apple	bin	900 lbs
Orange	bin	900 lbs
Kiwifruit	tray	7 lbs
Pasture	animal unit month (AUM)	1,000 lbs
Cotton	bale	500 lbs

Table 4. Yield basis conversion factors.

Crop	Reported Basis	Standard Basis	Conversion Factor to Standard Basis
Almond	gross	kernel	0.27
Almond	in-shell	kernel	0.59
Walnut	gross	in-shell	0.82
Walnut	kernel	in-shell	2
Pistachio	gross	in-shell	0.82
Pecan	kernel	in-shell	2
Prune	fresh fruit	dried fruit	0.33

4.3 DATA EXCLUSIONS

After outreach was completed, the following exclusions were made prior to statistical analysis:

1. Exempt crops (rice, non-irrigated crops, fallow, pasture with no N applied, or aquaculture)
2. Missing a required parameter for analysis (crop, N applied, yield, or yield unit)
3. N applied greater than 600 lbs/acre (lower threshold of 450 lbs/ac was used for member follow-up during QC)
4. Yield values above or below the reasonable range for the reported crop, shown in Appendix C
5. Zero yield or non-bearing

4.4 NITROGEN REMOVED DATA SOURCES AND PROCEDURES

After data exclusion, A/R and A-R were calculated for all remaining records, where possible. For crops where R could not be calculated, A/Y was calculated instead. To calculate R, the amount of N removed in the harvested portion of each crop, the Coalition relied on estimates from:

- *Nitrogen concentrations in harvested plant parts - A literature overview (Geisseler, 2016)*
- *Nitrogen concentrations in harvested plant parts - March 2021 update (Geisseler, 2021)*

These reports include information on N removal values for each crop as shown in Table 5, and include complete references for studies providing N removal data, as well as the following information:

- A coefficient of variation (CV) is provided, which indicates the variability among the published values for a specific crop.
- The number of published values both within and outside of California is also shown. In some cases, there are several studies that provide N removal values; in other cases, there are only one or two studies. Similarly, for some crops N removal values are reported from various parts of the Central Valley, while for other crops, values may be for other states.
- The time period when the values were published are presented in the detailed discussion of each crop.

While Geisseler (2016; 2021) provides several factors to evaluate the relevance of N removal values, it does not give an overall confidence rating or reflect all the information and criteria that need to be considered to determine how well the N removal values represent crop varieties grown within the Coalition. Therefore, the N removal values in Geisseler (2016; 2021) are used in this analysis because they are the best available sources of data, but they should not be considered definitive for all crops, and they should be expected to change and improve over time.

The N accumulated in the perennial tissues of permanent crops, which can vary be age, is also added to the amount of N removed, where values are available. Currently, Geisseler (2016; 2021) only provides values for almonds for perennial tissue accumulation, which are listed by orchard age in Table 6. These values were added to the N removed for the 2021 CY for any almond orchards with planting year reported. If planting year was not reported for an almond orchard, the perennial tissue N removed was not included in the AR ratios.

Table 5. N removed (R) conversion factors.

Crop	No. of Observations		CV (%)	R Conversion Factor (lbs N/ lbs yield)	Yield Basis
	CA	Total			
Field Crops					
Alfalfa – Hay	49	49	12.5	0.03115	12% moisture
Alfalfa – Silage	6	6	17.5	0.01200	65% moisture
Barley – Grain	4	61	14.6	0.01680	12% moisture
Barley – Straw	0	970	31.3	0.00770	12% moisture
Beans, Dry – Blackeye	1	164	10.4	0.03650	12% moisture
Beans, Dry – Garbanzo	2	108	11.3	0.03360	12% moisture
Beans, Dry – Lima	2	75	5.4	0.03615	12% moisture
Corn – Grain	0	1,775	20.8	0.01200	15.5% moisture
Corn – Silage	96	96	10.9	0.00377	70% moisture
Cotton	49	49	16.1	0.06200	lint
Fescue, Tall – Hay	260	260	16.2	0.02540	12% moisture
Oat – Grain	0	134	9.6	0.01885	12% moisture
Oat – Straw	2	526	34.7	0.00740	12% moisture
Oat – Hay	49	49	18.2	0.01085	12% moisture
Orchard Grass – Hay	60	60	20	0.02725	12% moisture
Ryegrass, Perennial – Hay	60	60	16.8	0.02745	12% moisture
Safflower	140	140	10.2	0.02585	8% moisture
Sorghum – Grain	0	256	29.7	0.01650	13.5% moisture
Sorghum – Silage	260	260	21	0.00367	65% moisture
Sunflower	24	24	11.1	0.03160	8% moisture
Triticale – Grain	51	51	13	0.02020	12% moisture
Triticale – Straw	0	102	38.3	0.00575	12% moisture
Triticale – Silage	19	19	13.7	0.00452	70% moisture
Wheat, Common – Grain	113	113	10.3	0.02150	12% moisture
Wheat – Straw	3	494	33	0.00690	12% moisture
Wheat – Silage	39	39	18.6	0.00525	70% moisture
Wheat, Durum – Grain	41	41	3.7	0.02105	12% moisture
Vegetables					
Asparagus	2	19	14	0.00293	fresh spears
Beans, Green	1	122	25.7	0.00289	fresh weight
Broccoli	15	46	20.4	0.00560	fresh weight
Carrots	64	64	22.7	0.00140	fresh weight
Corn, Sweet	0	50	13.1	0.00359	fresh ears

Crop	No. of Observations		CV (%)	R Conversion Factor (lbs N/ lbs yield)	Yield Basis
	CA	Total			
Cucumbers	1	10	17.4	0.00108	fresh weight
Garlic	1	12	19.5	0.00755	fresh weight
Lettuce, Iceberg	45	68	16.7	0.00132	fresh weight
Lettuce, Romaine	14	26	13.7	0.00181	fresh weight
Melons, Cantaloupe	1	31	15.5	0.00244	melons
Melons, Honeydew	1	12	22.1	0.00148	melons
Melons, Watermelons	1	6	23.9	0.00070	melons
Onions	13	45	19.7	0.00197	fresh weight
Pepper, Bell	6	40	7.9	0.00166	fresh weight
Potatoes	5	64	13.6	0.00312	fresh weight
Pumpkin	1	13	10.1	0.00368	fresh weight
Squash	11	74	22.4	0.00184	fresh weight
Sweet Potatoes	11	23	16.8	0.00237	fresh weight
Tomatoes, Fresh Market	1	34	16.5	0.00131	fresh weight
Tomatoes, Processing	195	195	15.0	0.00146	fresh weight
Tree and Vine Crops					
Almonds	31	31	4.1	0.06800	kernels
Apples	1	132	35.1	0.00054	fruits
Apricots	1	22	114	0.00278	fruits
Cherries	1	24	19.8	0.00221	fruits
Figs	1	19	18.1	0.00127	fruits
Grapefruit	26	27	7.8	0.00148	fruits
Grapes – Raisins	16	19	5.8	0.00505	15% moisture
Grapes – Table	16	19	5.8	0.00113	grapes
Grapes – Wine	8	38	13	0.00180	grapes
Lemons	21	22	10	0.00129	fruits
Nectarines	31	41	27.1	0.00182	fruits
Olives	6	29	22.8	0.00314	fruits
Oranges	26	82	10.9	0.00148	fruits
Peaches	81	81	19.0	0.00152	fruits
Pears	1	64	17.9	0.00065	fruits
Pistachios (CPC)[e]	11	11	3.5	0.02805	dry yield (CPC)
Pistachios (gross)	156	156	21.6	0.01020	green weight
Plums	24	24	14.5	0.00114	fruits
Pomegranate	0	7	15	0.00200	fruits

Crop	No. of Observations		CV (%)	R Conversion Factor (lbs N/ lbs yield)	Yield Basis
	CA	Total			
Prunes	18	18	16.3	0.00560	dried fruits
Tangerines	1	2	29.2	0.00127	fruits
Walnuts	24	24	10.9	0.01590	in-shell

Notes:

a. Conversion factors are calculated from N concentrations expressed in lbs/ton at a moisture content common for the respective crop at harvest.
b. The calculated value for N removed is only accurate on a multi-year basis and may not be accurate for a specific year.
c. For perennial crops, N accumulation in perennial tissue is not included in the value, except for almonds.
d. For most crops where marketable yield is reported and cull or trash is removed in a processing facility, the calculated amount of N removed underestimates the actual amount because it does not include the N in cull or trash.
e. California Pistachio Commission (CPC) assessed yield is adjusted to 5% moisture and includes the weight of edible, split nuts containing kernels, shelling stock (both kernels and shells), and unsplit nuts containing kernels. Culls such as nuts with insect damage, dark stains, adhering hulls, and other rejects are not included in CPC-assessed yield determinations.

Table 6. Perennial tissue N removed.

Crop	Age (years)	N demand for leaf and woody biomass (lbs/acre)
Almond	1	30
	2	55
	3	65
	4	55
	5	45
	6-15	10
	16-25	30
Other Perennials	--	Not Available

4.5 Joining 2021 CY to Past Data

The 2021 CY INMP data was joined to the 2019 CY and 2020 CY INMP data to allow calculation of 3-yr AR ratios for eligible fields. The 2021 and 2020 CYs had field IDs that were used to link those years together; however, for the 2019 CY, field ID was not reported because the Order did not require field level reporting at that time. Thus, the 2019 data had to be joined by finding matches for APN and member, then reviewing other parameters such as acres, field name, MU, or crop to determine likely matches. This effort required a significant amount of time. While most of the matches are thought to be correct, there are likely some errors – fields that matched that are different or fields that didn't match that should have; however, all matches at minimum had to have the same APN and member, so any errors

would have had minimal effect on the results. In future years, this will no longer be an issue because field IDs will be available for the most recent 3 years of INMP data.

4.6 SPATIAL JOIN

The INMP data was joined to county parcel shapefiles, where possible, and the parameters used in the statistical analysis or required data deliverables were determined via spatial join in GIS. Parcel data was obtained for the most recent year available from each county where INMP data was reported, excluding portions of Modoc, Lassen, and Sierra counties where parcel data was not available. The INMP data was joined to the county parcel shapefiles using a combination of APN and county, since some counties share the same APNs. Many of the INMP APNs had to be reformatted to match the format of the parcel shapefiles. If a join match could not be found or if parcel data was not available, then the join parameters were left blank. There were 1,466 fields submitted that could not be matched to the county parcel shapefiles.

For the INMP records that could be mapped, the following parameters were determined via spatial join in GIS:

- Township and range –assigned based on the centroid of the parcel using the Public Land Survey System (PLSS) dataset from the California Department of Conservation Geologic Energy Management Division (CalGEM) (https://gis.data.ca.gov/datasets/cadoc::public-land-survey-system-plss-sections/about)
- Groundwater basin and sub-basin – assigned based on the centroid of the parcel using the California Department of Water Resources (DWR) Bulletin 118 groundwater basins
- Soil type – ready-to-use USDA Soil Survey Geographic Database (SSURGO) information packaged by ESRI was obtained and parcels were assigned to the SSURGO polygon with the largest overlap (https://www.arcgis.com/apps/View/index.html?appid=cdc49bd63ea54dd2977f3f2853e07fff)

4.7 OUTLIER ANALYSIS

The INMP data was analyzed for statistical outliers using A/R. For perennial crops, 3-yr A/R ratios were used, while for annuals a different method was developed using single-year ratios because most of the annual crop fields did not have the same crop over time. The analysis was done at the Coalition level for each crop type following the procedure described below. All analyses were performed using Python.

4.7.1 CROP GROUPING

The Coalition grouped similar crops together for the statistical analysis. Crops that were grouped into different categories than the specific crop type reported are shown in Table 7. Crops that were harvested in different ways (e.g. grain corn vs. silage corn) or different varieties (e.g. processing vs. fresh market tomatoes) were separated for the analysis. Some members did not indicate the specific crop type for these crops on their report. The Coalition attempted to determine this via follow-up with the member or by comparison of the reported yield to typical values. If the specific crop type could not be determined, it was followed by "-NR" indicating it was not reported.

Planting year for perennial crops was also requested by the Coalition. This was used to separate orchards at full production age from younger orchards for the statistical analysis. Since younger orchards generally have lower yields, the N removed rates are not comparable to orchards at full production. Only the orchards at full production age were analyzed for outliers. Since approximately 60% of the perennial crop fields did not have a planting year reported, orchards without a planting year were assumed to be at full production. The age thresholds used to determine full production age are shown in Table 8 and were developed from a combination of UCCE publications and expert opinion (A. Fulton - UCCE, personal communication). For almonds and walnuts, if a field had a yield that did not make sense for the planting year (i.e. 3-yr old almonds with yield >2,000 lbs/ac), the field was still included in the outlier analysis and not marked as young since the planting year was suspect.

Table 7. Crop types for 2021 CY grouped into different categories for statistical analysis.

Specific Crop	Crop Grouping for Analysis
Pea - Field	Bean Dry
Blackberry	Berry
Blueberry	Berry
Mandarin	Citrus
Orange	Citrus
Grass Hay	Hay/Forage
Melon – Honeydew	Melon
Mulberry	Misc. Fruit Tree
Olive – Oil	Olive
Olive – Table	Olive
Kale – Seed	Seed Crop
Onion – Seed	Seed Crop
Sudangrass – Seed	Seed Crop
Radish – Seed	Seed Crop
Cucumber Seed	Vine Seed
Melon – Seed	Vine Seed
Pumpkin Seed	Vine Seed
Squash – Seed	Vine Seed
Watermelon – Seed	Vine Seed

Table 8. Orchard full production ages.

Crop	Full Production Age (yrs)	No. Analyzed Fields Below Full Production Age
Almond	6	525 (12%)
Cherry	9	2 (5%)
Citrus[a]	8	1 (1%)
Grape – Wine	4	53 (4%)
Kiwi	6	3 (5%)
Olive[b]	5	6 (1%)
Peach/Nectarine[c]	7	13 (3%)
Pear	8	5 (3%)
Pecan	8	5 (7%)
Pistachio	9	40 (26%)
Plum/Pluot	5	0 (0%)
Prune	8	50 (7%)
Walnut	8	402 (8%)

Notes:

a. Citrus value based on mandarins
b. Olive value based on high density oil olives
c. Peach/nectarine value based on processing varieties. Fresh pick varieties mature around year 5, but the Coalition did not require members to identify peach/nectarine varieties on their INMP summary reports.

4.7.2 Outlier Method

This was the first year that 3-yr ratios were calculated for A/R and A-R using INMP data from the 2019, 2020, and 2021 CYs. Prior to the 2020 CY, only HVAs had to report INMP data, so most of the low vulnerability areas only had 2 years of data and were not eligible for 3-yr ratios. In addition, field level tracking was not implemented until the 2020 CY, so there were some fields from the 2019 CY that could not be reliably tied to 2020 or 2021. To be eligible for the 3-yr ratios, a field had to have the following all 3 years:

- Same membership – multi-year ratios are meant to evaluate an individual grower's management
- Same field ID – data is reported at the field level by members as required by the Order
- Same crop type – different crops have different N use efficiencies and different management practices, so this criterion ensures that a member's management practices are being evaluated rather than the type of crop being grown. Grouping fields with the same crop rotation was determined to not be viable since the most common rotation in the Coalition only had 60 fields

and there were several hundred different combinations of annual crops grown over the 2019 – 2021 period.

- Orchard at full production age – young orchards generally have lower yields and higher average A/R values compared to full production orchards, so it is not fair to compare them to mature crops as the outliers will be skewed towards younger fields.
- No flags for zero yield, questionable or exempt data – AR ratios cannot be calculated if yield is zero, and questionable data are excluded since these are generally reporting errors and are not accurate data.
- Crop has a nitrogen removal coefficient – this is required to calculate A/R and A - R

Out of the 19,911 fields that were analyzed for the 2021 CY (Table 10), 4,906 (25%) were eligible using these criteria, with a large percentage of the eligible fields being perennial crops (4,757 – 95%). The remaining 75% were not eligible for 3-yr ratios for the following reasons:

- 2,806 fields (14%) – crop type was not the same between 2019 – 2021. Half of these were annual crop fields (1,456 fields)
- 1,105 fields (6%) – young orchards, shown in Table 8
- 8,452 fields (42%) – low vulnerability areas - only 2 years of data
- 1,569 fields (8%) – high vulnerability areas with either no data or no match for 2019 CY
- 122 fields (0.6%) – have data for 2021 and 2019 CY but no data for 2020 CY
- 951 fields (5%) – crops without R factors not already covered by above criteria

For annual crops, this would result in only 150 fields being 3-yr eligible, and only 2 of these would have been outliers using 3-yr ratios. This is because annual crop fields are often rotated between different crops. For example, sunflower is one of the highest acreage annual crops in the Coalition, but there were only five sunflower fields that met the above criteria. Thus, for annual crops a different method was developed to identify outliers than for perennial crops. The two methods used were:

- Annual crops – single year A/R ratios were used, and outliers were considered any fields that were single year outliers in 2021 and at least one of the two prior years (2019 or 2020) for any crop. This results in a higher number of outliers (18 fields) than with the multi-year method (2 fields).
- Perennial crops – 3-yr A/R ratios were used and the fields that were not eligible in one or more of the three years were disqualified.

Only high outliers represent potential over-application of N fertilizer and were counted as outliers. For both the annual and perennial crops, the outlier thresholds were calculated the same way using pooled 1-year A/R ratios from CY 2019 through 2021 to provide a larger sample size than if only fields with 3-yr ratios or single-year ratios for 2021 were used. The multi-year outlier thresholds were then compared to 3-yr ratios for perennial crops to identify 3-yr outliers and the 2019 – 2021 single year ratios for annual crops to identify fields that were outliers in 2021 and one or more prior years. The list of which crops used the single year vs. multi-year ratios for outlier determination is provided in Table 9.

The outlier threshold was calculated for each crop grouping via the adjusted boxplot method of Hubert and Vandervieren (2008). This method adjusts the outlier threshold for skewness using the medcouple statistic (MC). When the data distribution is perfectly symmetrical, MC = 0 and the upper threshold is the standard method of Q3 + 1.5*IQR from Tukey (1977). For any crops (annuals or perennials) that had less than 20 fields for the 2021 CY, outliers were not calculated because of the small sample size that limits the reliability of the analysis.

Table 9. Outlier methods for perennial and annual crops

Crop Type	Outlier Method	Dataset Used to Calculate Outlier Threshold
Perennials	3-yr A/R above outlier threshold for eligible fields with same crop type	Pooled single year A/R for all fields of the same crop between 2019 – 2021 CY
Tree and vine crops		
Asparagus		
Alfalfa		
Grass Hay		
Annuals	1-yr A/R above outlier threshold for 2021 CY and for any past crops grown on same field for 2019 OR 2020 CY	
Vegetables		
Field Crops		
Grain Hay		

4.8 SUMMARY STATISTICS

The INMP summary statistics required by the Order were calculated for each crop type grouping and included the mean, standard deviation, minimum/maximum values, histogram plots, and box and whisker plots (boxplots) for A/R and A-R. The number of outliers for A/R, using the methods described above was also included. For crops without R values, A/Y values are shown instead of A/R and A-R. Non-bearing or zero yield fields were not included in the statistics since A/R cannot be calculated for these fields. Young orchards did not have outliers calculated, but the other summary statistics are presented. Crops with less than 20 fields for the 2021 CY or unspecified crop categories (e.g., “other”, “misc. fruit tree”) did not have boxplots or outliers calculated due to the small sample size or mix of crops and are provided in tabular format.

The boxplots were generated using the standard method of Tukey (1977) while the red dashed line shows the outlier threshold which was determined using the method of Hubert and Vandervieren (2008). To avoid skewing the display of the boxplots and histograms, values greater than three times the difference between the upper and lower whisker, using the Tukey (1977) method, are not shown, although they were still included in the calculation of outliers. An interpretation diagram for the boxplot is provided in Figure 2. Outliers for perennial crops are dots above the red dashed line on the 3-yr A/R plot. For annual crops, dots above the red dashed line that were also outliers in 2019 or 2020 for any crop grown on the same field are counted as multi-year outliers.

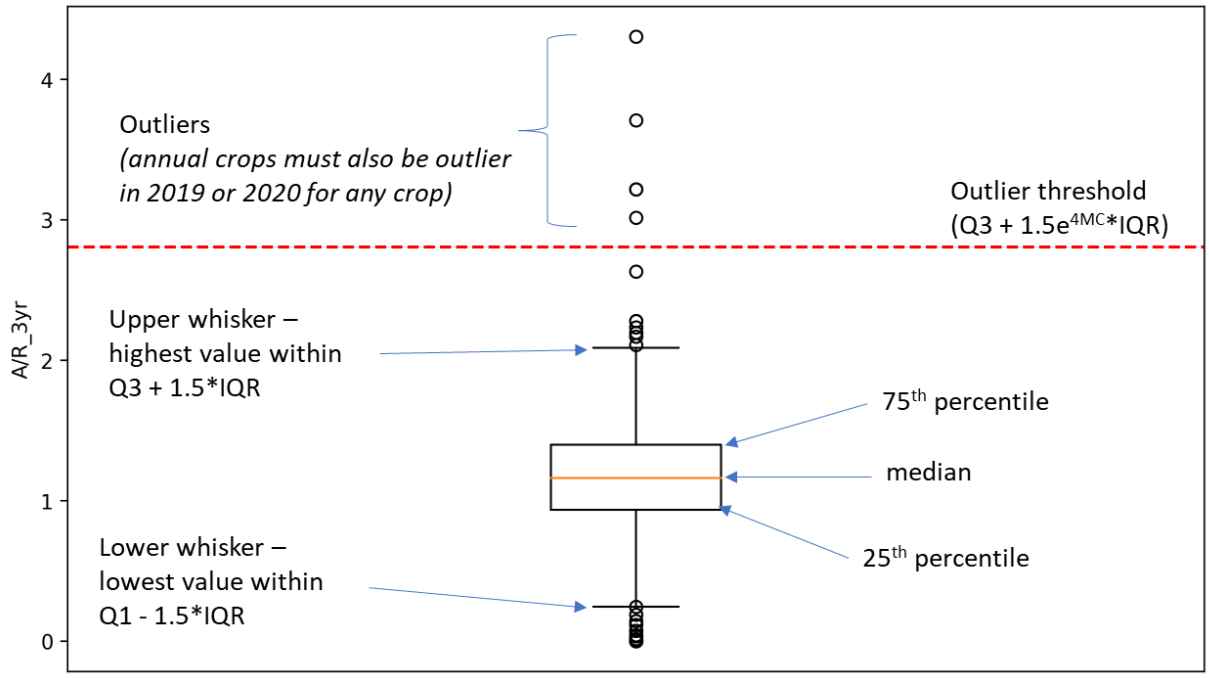


Figure 2. Interpretation diagram for box and whisker plot.

4.9 Soil and Irrigation Type Analysis

The WDRs require that the evaluation of AR ratios by crop type include an evaluation of irrigation method, soil conditions, and farming operation size. Farming operation size is not currently requested from members on the approved INMP Summary Report or FE Templates, so this factor could not be analyzed. Members can have operations that span multiple subwatersheds, farm fields for multiple property owners, or have fields that were exempt from reporting such as pasture and rice, which makes defining the operation size difficult. Soil conditions were assessed using drainage class that was assigned during the spatial join, and irrigation method was assessed using the response to the irrigation method question on the INMP Summary Reports.

4.9.1 Soil Type Evaluation

Soil drainage class was selected to further evaluate outlier status at the Coalition level for each crop type. Soil drainage class refers to the frequency and duration of wet periods under conditions similar to those under which the soil developed. Anthropogenic alteration of the water regime, either through drainage or irrigation, is not a consideration unless the alterations have significantly changed the morphology of the soil. Soil drainage class was obtained from the dominant condition in the SSURGO dataset for the map unit with largest overlap assigned to each parcel. The drainage classes were then aggregated into four classes:

1. Well Drained
    - Excessively Drained

    - Somewhat Excessively Drained
    - Well Drained
2. Moderately Well Drained
3. Somewhat Poorly Drained
4. Poorly Drained
    - Poorly Drained
    - Very Poorly Drained

The influence of soil drainage class on A/R values for each crop was assessed using a Kruskal-Wallis one-way analysis of variance (ANOVA). This is a non-parametric test that evaluates (for each crop type) the hypothesis that all drainage classes have the same mean A/R values. For annuals crops, the test was conducted on single year A/R values for the 2021 CY, while for perennials, the test was conducted on fields with 3-yr A/R ratios. A result was considered statistically significant for *p*-values < 0.05. If a significant result was obtained for a given crop, a follow-up test was completed using Dunn's test, a non-parametric multiple comparisons test, to identify which of the drainage classes were significantly different from each other. The Dunn's test *p*-values were adjusted for error using the Bonferroni adjustment. The soil type evaluation was not performed for crops without R values or with a small number of observations. Results of the soil type evaluation are provided in Section 4.10.2.

4.9.2 Irrigation Type Evaluation

Irrigation type was reported by growers with the 2021 CY INMP data. The influence of primary irrigation type on A/R values for each crop was assessed using a Kruskal-Wallis ANOVA. For annuals crops, the test was conducted on single year A/R values for the 2021 CY, while for perennials, the test was conducted on fields with 3-yr A/R ratios. Dunn's test with a Bonferroni adjustment was performed for any crops with a significant effect (*p*-values < 0.05) to identify which irrigation methods were significantly different from each other. The irrigation type evaluation was not performed for crops without R values or with a small number of observations. Results of the irrigation type evaluation are provided in Section 4.10.3.

4.10 Results

4.10.1 Irrigation and Nitrogen Management Plan

The crop acreages from the INMP Summary Reports included in the statistical analysis are shown in Table 10 and are sorted by acres. The top five crops by acreage were almonds, walnuts, wine grapes, processing tomatoes, and alfalfa, respectively. Also shown in Table 10 are the acres and number of fields by crop for records that were (1) analyzed, (2) non-bearing or zero yield, or (3) exempt or questionable data. The A/R and A-R summary statistics, histograms, boxplots, and number of outliers for each crop type analyzed are provided in Appendix A.

For annual crops, there were 18 fields that were considered outliers, meaning they were outliers for the 2021 CY and at least one out of the previous two years for A/R. For perennial crops, there were 45 fields that were outliers, which were based on the 3-yr A/R ratios.

Table 10. Summary of crops reported on INMP summary reports.

Crop	Analyzed		Non-Bearing or Zero Yield		Exempt or Questionable Data[a]	
	Fields	Acres	Fields	Acres	Fields	Acres
Almond	4,476	225,192	691	33,128	110	3,612
Walnut	5,068	195,316	652	24,025	183	5,664
Grape - Wine	1,420	69,097	118	2,518	29	168
Tomato - Processing	1,245	67,146	9	779	13	522
Alfalfa - Hay	1,154	62,334	108	5,161	31	1,371
Sunflower	698	37,280	23	1,046	29	249
Wheat - Grain	575	28,918	42	1,668	48	255
Prune	751	26,832	105	4,065	21	275
Corn - Grain	352	23,355	2	169	8	179
Olive	512	19,322	157	3,807	50	450
Hay/Forage	378	18,285	64	3,306	126	4,285
Pasture	181	13,667	1,132	46,596	2,204	104,939
Pistachio	151	9,788	75	4,564	9	857
Peach/Nectarine	427	9,431	20	206	20	234
Sudangrass - Hay	97	8,145	3	113	3	0
Safflower	139	6,899	2	99	18	15
Vine Seed	188	6,583	4	144	4	59
Corn - Silage	114	6,087	3	110	1	0
Triticale - Grain	126	6,062	10	128	12	81
Pear	190	5,901	11	197	7	374
Bean Dry	129	5,531	9	335	8	223
Rice - Wild	65	4,589	4	176	1	0
Wheat - Hay	51	4,491	3	134	12	120
Misc. Row Crop	36	2,709	10	327	6	233
Misc. Fruit Tree	143	2,546	32	467	13	130
Seed Crop	73	2,468	12	166	1	79
Orchardgrass - Hay	34	2,308	0	0	4	141
Ryegrass - Hay	59	2,195	12	429	36	0
Oat - Hay	61	2,182	12	433	25	0
Plum/Pluot	56	1,819	9	36	2	12
Pecan	68	1,642	28	907	0	0
Cherry	42	1,517	15	28	1	1
Sorghum - Grain	29	1,448	1	30	1	24
Kiwi	65	1,422	8	354	3	3
Cotton	19	1,362	0	0	1	57
Melon	24	1,322	3	41	0	0
Cucumber	36	1,308	1	65	0	0

Crop	Analyzed		Non-Bearing or Zero Yield		Exempt or Questionable Data[a]	
	Fields	Acres	Fields	Acres	Fields	Acres
Misc. Vegetable	75	1,243	19	145	2	6
Pepper	35	1,217	0	0	0	0
Vetch	25	1,094	1	5	2	0
Barley - Grain	20	899	1	18	0	0
Grain Hay	22	833	4	106	11	153
Bean - Green	11	626	0	0	1	0
Garlic	13	567	0	0	0	0
Turf	7	563	3	205	0	0
Triticale - Hay	14	522	0	0	3	0
Citrus	78	515	12	50	15	49
Corn - Popcorn	6	479	0	0	0	0
Watermelon	15	476	3	116	4	70
Cilantro	7	455	0	0	1	0
Timothy grass - Hay	8	454	0	0	0	0
Apple	31	402	10	46	6	5
Flower/Ornamental	11	385	15	158	3	12
Pumpkin	22	361	3	41	1	8
Other	13	352	29	2,088	7	39
Alfalfa - Silage/Haylage	10	350	0	0	0	0
Persimmon	31	344	6	32	0	0
Grape Rootstock	10	329	16	199	0	0
Corn - Sweet	11	292	0	0	0	0
Dichondra	5	246	3	140	0	0
Research	25	234	35	264	0	0
Barley - Hay	6	225	0	0	1	71
Sudangrass - Silage	6	211	0	0	0	0
Fig	12	188	1	4	0	0
Onion	5	163	4	95	0	0
Wheat - Silage	3	153	0	0	6	0
Strawberry	12	136	5	11	0	0
Oat - NR[b]	4	125	0	0	1	19
Sudangrass - Greenchop	5	118	0	0	1	0
Asparagus	3	117	6	35	5	117
Misc. Nut Tree	6	108	2	15	0	0
Grape - Other	8	98	4	14	0	0
Berry	18	93	8	12	2	17
Cover Crop	8	91	14	293	26	0
Nursery	9	91	27	454	1	5
Sorghum - Hay	2	72	0	0	0	0

Crop	Analyzed		Non-Bearing or Zero Yield		Exempt or Questionable Data[a]	
	Fields	Acres	Fields	Acres	Fields	Acres
Winter Grain	4	69	0	0	3	0
Millet - Grain	1	69	0	0	0	0
Chestnut	9	66	2	16	0	0
Ryegrass - Silage/Haylage	3	66	0	0	24	0
Sorghum - Greenchop	5	62	0	0	0	0
Squash	6	60	7	71	0	0
Sorghum - Silage	2	55	0	0	0	0
Christmas Tree	2	53	24	184	1	3
Triticale - Silage/Haylage	1	42	0	0	0	0
Mint	1	35	0	0	0	0
Beet	2	32	1	1	0	0
Hops	6	27	5	6	0	0
Pomegranate	2	24	7	8	0	0
Apricot/Aprium	9	20	5	3	1	0.20
Kohlrabi	1	19	0	0	0	0
Pea - Fresh	1	18	0	0	0	0
Winter Vegetable	2	16	0	0	0	0
Corn - NR	1	16	11	193	0	0
Okra	1	13	0	0	0	0
Oat - Silage	1	12	3	52	5	0
Radish	1	10	0	0	0	0
Truffle	1	7	0	0	0	0
Grape - Table	1	4	0	0	1	7
Broccoli	1	3	0	0	0	0
Lavender	1	2	2	1	0	0
Eggplant	1	1	0	0	0	0
Cabbage	1	0.34	0	0	0	0
Agave	0	0	1	3	0	0
Alfalfa - NR	0	0	0	0	2	87
Aquaculture	0	0	11	844	13	885
Carrot	0	0	1	27	0	0
Fallow	0	0	4	0	825	383
Hazelnut	0	0	1	1	0	0
Hemp	0	0	3	91	0	0
Herb/Spice	0	0	4	26	0	0
Leek	0	0	1	0.33	0	0
Lettuce	0	0	1	0.25	0	0
Misc. Field Crops	0	0	0	0	1	26
Non-Irrigated Crop	0	0	8	217	24	237

Crop	Analyzed		Non-Bearing or Zero Yield		Exempt or Questionable Data[a]	
	Fields	Acres	Fields	Acres	Fields	Acres
Oat - Grain	0	0	2	39	5	0
Rangeland	0	0	0	0	10	0
Rice	0	0	16	1,057	80	2,831
Sorghum - NR	0	0	1	7	0	0
Tomato - Fresh Market	0	0	1	0.15	1	20
Tomato - NR	0	0	14	382	9	364
Triticale - NR	0	0	0	0	1	49
Total	**19,911**	**902,529**	**3,757**	**143,529**	**4,397**	**135,180**

Notes:

a. Excludes incomplete records or fields that were not required to report (e.g. non-irrigated)
b. NR - specific crop type not reported. A/R and A-R could not be calculated for this category.
c. Fields can be counted in multiple categories if multi-cropped.

4.10.2 Soil Type Evaluation Results

Eight annual crops and seven perennial crops had large enough sample sizes to include in the soil type evaluation. The results are summarized in Table 11. For the annuals, five crops had a significant effect (*p*-value <0.05): silage corn, grain corn, safflower, tomatoes, and triticale; however, the drainage classes that were significantly different from each other varied by crop. For example, in grain corn the poorly drained class had significantly lower A/R than well drained soils, but for safflower, the poorly drained fields had significantly higher A/R than well drained soils.

For perennials, five crops had a significant effect: alfalfa hay, almond, wine grapes, prune, and walnut. The drainage classes that were significantly different from each other varied by crop with no consistent trends, and the highest mean 3-yr A/R occurred in every drainage class except for poor drainage.

Table 11. Evaluation of soil drainage class effect on A/R.

Crop	Drainage Class	Fields	Mean A/R	Significant Effect[a]
Annual Crops (1-yr A/R)				
Bean Dry	Well	53	0.8978	NS
	Moderately well	26	0.7548	NS
	Somewhat poorly	40	0.7743	NS
	Poorly	8	0.9153	NS
Corn – Silage	Well	29	5.6329	a
	Moderately well	36	1.0059	a
	Somewhat poorly	24	0.9098	a
	Poorly	22	1.2639	a
Corn – Grain	Well	89	1.5519	a
	Moderately well	45	2.1979	a
	Somewhat poorly	70	1.6753	a

Crop	Drainage Class	Fields	Mean A/R	Significant Effect[a]
	Poorly	138	1.2365	b
Safflower	Well	30	1.5076	a
	Moderately well	9	1.6292	ab
	Somewhat poorly	20	1.7560	ab
	Poorly	68	2.1729	b
Sunflower	Well	271	3.2503	NS
	Moderately well	149	3.4640	NS
	Somewhat poorly	126	3.6211	NS
	Poorly	125	3.2476	NS
Tomato - Processing	Well	536	1.4483	a
	Moderately well	157	1.5794	b
	Somewhat poorly	236	2.0557	b
	Poorly	261	1.7554	b
Triticale – Grain	Well	10	1.0361	a
	Moderately well	12	0.5396	a
	Somewhat poorly	10	0.6196	a
	Poorly	90	1.1078	a
Wheat - Grain	Well	198	0.9442	NS
	Moderately well	82	1.1213	NS
	Somewhat poorly	134	1.0265	NS
	Poorly	134	0.9029	NS
Perennial Crops (3-yr A/R)				
Alfalfa – Hay	Well	91	0.1064	a
	Moderately well	71	0.1149	a
	Somewhat poorly	60	0.0639	b
	Poorly	49	0.0490	b
Almond	Well	841	1.1718	a
	Moderately well	168	1.1269	b
	Somewhat poorly	77	1.2081	ab
	Poorly	38	1.1281	ab
Grape – Wine	Well	9	1.5135	a
	Moderately well	7	0.7813	a
	Somewhat poorly	64	0.9726	a
	Poorly	103	1.1156	a
Olive	Well	80	2.8358	NS
	Moderately well	8	2.7596	NS
	Somewhat poorly	7	3.2569	NS
	Poorly	3	2.3211	NS
Peach/Nectarine	Well	45	7.4311	NS
	Moderately well	134	7.3720	NS
	Somewhat poorly	1	0.0000	NS
	Poorly	1	2.4889	NS

Crop	Drainage Class	Fields	Mean A/R	Significant Effect[a]
Prune	Well	122	4.5702	a
	Moderately well	143	5.7666	b
	Somewhat poorly	30	4.6395	ab
	Poorly	13	3.8012	ab
Walnut	Well	1285	1.7300	a
	Moderately well	556	2.0593	b
	Somewhat poorly	426	1.8924	c
	Poorly	39	1.9713	abc

Notes:

a. Different letters indicate significant difference (*p*-value <0.05); NS = not significant

4.10.3 Irrigation Type Evaluation Results

Eight annual crops and seven perennial crops had large enough sample sizes to include in the irrigation type evaluation. Most of the crops tested do not have an even distribution of observations since certain irrigation methods are less common for some crops (i.e. flood is not very common for orchards or vineyards). Some irrigation methods had less than five observations which is generally considered too small for the Kruskal-Wallis test to be reliable.

The results are summarized in Table 12. For the annuals, all eight crops had a significant effect (*p*-value <0.05). There were no irrigation methods that were consistently more efficient across all annuals, but drip did have lower mean A/R compared to flood and/or furrow for wheat, tomatoes, sunflower, and safflower. Grain corn and dry beans did not follow this same pattern as drip had higher mean A/R values than furrow.

For perennials, four of the seven crops had a significant effect, though some of the methods that were significantly different had a small sample size. For example for peach/nectarine, micro-sprinkler contained 83% of the observations and the other irrigation methods all had less than 10%, limiting the reliability of the analysis. For almonds, most of the observations were from three classes – drip, sprinkler, and micro-sprinkler – which had no significant differences. Drip, sprinkler, and micro-sprinkler had slightly lower mean A/R compared to flood and furrow in walnuts. Wine grapes, olives, and prunes did not have significant effects.

Table 12. Evaluation of irrigation type effect on A/R.

Annuals	Irrigation Type	Fields	Mean A/R	Significant Effect[a]
Annual Crops (1-yr A/R)				
Bean Dry	Drip	41	1.1334	a
	Furrow	70	0.6785	b
	Micro Sprinkler	1	0.8953	ab
	Sprinkler	15	0.7096	ab

Annuals	Irrigation Type	Fields	Mean A/R	Significant Effect[a]
Corn - Silage	Border Strip	2	1.0624	a
	Drip	2	0.8777	a
	Flood	29	5.5005	a
	Furrow	71	1.1368	a
	Sprinkler	1	0.5312	a
	Sub-Irrigation	6	0.7615	a
Corn - Grain	Border Strip	1	0.8333	abcd
	Drip	78	1.7465	d
	Flood	22	2.2164	bcd
	Furrow	175	1.4064	bc
	Micro Sprinkler	1	1.6842	abcd
	Sprinkler	16	2.5485	abcd
	Sub-Irrigation	49	1.0315	a
Safflower	Drip	18	1.2969	a
	Flood	13	2.7557	b
	Furrow	39	1.7639	ab
	Sprinkler	36	2.0793	b
	Sub-Irrigation	9	2.7401	b
Sunflower	Drip	308	3.0796	a
	Flood	26	4.4214	a
	Furrow	322	3.5406	a
	Micro Sprinkler	3	1.9024	a
	Sprinkler	9	4.7424	a
	Sub-Irrigation	1	2.2604	a
Tomato - Processing	Drip	962	1.6246	a
	Flood	2	0.3645	ac
	Furrow	162	1.8588	bcd
	Micro Sprinkler	2	1.1802	ad
	Sprinkler	54	1.6087	bd
	Sub-Irrigation	8	1.7037	ad
Triticale - Grain	Border Strip	9	0.2882	a
	Drip	8	0.5480	ab
	Flood	15	0.9810	ab
	Furrow	24	0.8253	ab
	Sprinkler	35	0.9891	b
	Sub-Irrigation	21	1.7253	b
Wheat - Grain	Border Strip	20	0.8299	ab
	Drip	129	0.7801	a
	Flood	123	0.8929	b
	Furrow	150	1.1261	b
	Sprinkler	54	1.3051	b
	Sub-Irrigation	6	0.0822	a

Annuals	Irrigation Type	Fields	Mean A/R	Significant Effect[a]
Perennial Crops (3-yr A/R)				
Alfalfa – Hay	Border Strip	19	0.0409	ad
	Drip	1	0.0000	acd
	Flood	174	0.0961	bd
	Furrow	39	0.1280	bc
	Sprinkler	38	0.0417	a
Almond	Border Strip	3	1.7418	ab
	Drip	199	1.1727	b
	Flood	19	1.4927	a
	Furrow	1	1.1903	ab
	Micro Sprinkler	432	1.1442	b
	Sprinkler	470	1.1666	b
Grape – Wine	Drip	162	1.0848	NS
	Flood	8	0.9853	NS
	Furrow	9	0.9428	NS
	Micro Sprinkler	1	0.9068	NS
	Sprinkler	3	1.0775	NS
Olive	Border Strip	1	1.4862	NS
	Drip	65	2.4667	NS
	Flood	14	3.1688	NS
	Micro Sprinkler	17	3.9983	NS
	Sprinkler	1	4.5496	NS
Peach/Nectarine	Border Strip	2	2.3536	ab
	Drip	4	2.8837	ab
	Flood	8	2.4393	b
	Micro Sprinkler	152	7.2206	b
	Sprinkler	15	12.7627	a
Prune	Border Strip	3	6.1302	NS
	Drip	57	4.0556	NS
	Flood	28	5.0394	NS
	Micro Sprinkler	189	5.2985	NS
	Sprinkler	30	5.7439	NS
	Sub-Irrigation	1	6.4004	NS
Walnut	Border Strip	5	3.4933	ab
	Drip	59	1.8497	ab
	Flood	107	2.0004	ab
	Furrow	18	2.6484	a
	Micro Sprinkler	969	1.9261	b
	Sprinkler	1148	1.7390	b

Notes:

a. Different letters indicate significant difference (p-value <0.05); NS = not significant

4.11 CONCLUSIONS

The Coalition received INMP data for 24,072 fields representing 5,867 members and 1,091,248 acres. The member return rate for the 2021 CY was 97%, which was slightly higher than 2020 CY (94%) and the same as 2019 CY (97%). For the fields with data submitted, 19,911 were included in the analysis while the remainder were excluded for being non-bearing, exempt or having questionable data. The top five crops reported by acreage were almonds, walnuts, wine grapes, processing tomatoes, and alfalfa, respectively. The INMP data was analyzed for statistical outliers using A/R. For perennial crops, 3-yr A/R ratios were used which required the field to have the same crop and be at full production age for all 3 years. There were 45 perennial crop fields considered outliers. For annuals, fields had to be outliers in 2021 and one of the two previous years for any crop using single year A/R ratios. There were 18 annual crop fields that were considered outliers.

Soil drainage class did not appear to have a consistent effect on A/R as the drainage class with the highest A/R varied by crop. Every drainage class except for poorly drained had the highest mean A/R for at least one crop.

Irrigation method may have had an influence on A/R in some crops, but overall there was not a clear trend and many irrigation methods had less than 10 observations, limiting the reliability of the analysis. For annuals, several crops had lower A/R with drip irrigation compared to flood or furrow, but some annuals had the opposite effect. For perennials, walnuts had had slightly lower A/R for drip, micro-sprinkler, and sprinkler compared to flood or furrow, but this pattern was not seen for any of the other crops.

4.12 MEMBER FEEDBACK AND OUTREACH

Member outreach is expected to occur over the 2022-23 winter. Outreach activities will include individualized feedback reports sent to each member in the Coalition who submitted N application and yield data. The reports will include a table showing individual values for each member's fields, 3-yr AR ratios for perennials crops, and Coalition averages for N applied, A/R, and A-R. An example of an individual member feedback report is provided in Appendix C.

The member feedback report is designed to show N use efficiency for the member's fields within the context of other members in the Coalition. Members are also encouraged to contact the Coalition if they identify any incorrectly reported values that were not identified during the data review process.

5 ANNUAL IRRIGATION AND NITROGEN MANAGEMENT PLAN SUMMARY REPORT DATA

The annual INMP Summary Report data is provided in Attachment 2 (Excel workbook format) and is organized into the following three tables:

- Individual field-level AR data by anonymous member ID

- Individual field-level AR data by anonymous APN ID
- Township-level aggregated AR data table

In the township data table, fields that could not be mapped spatially have the township listed as "unknown". For crops without N removal coefficients, A/R and A-R are blank since R could not be calculated. Outliers for perennial crops were determined using 3-yr A/R while annual crops were considered outliers if the 1-yr A/R was above the outlier threshold for the 2021 CY and either the 2020 or 2019 CY.

6 SUMMARY OF ANNUAL MANAGEMENT PRACTICE INFORMATION

This section summarizes the management practice information collected through the INMP Summary Reports for the 2021 CY. The annual management practice implementation data collected through the INMP Summary Reports (irrigation method, irrigation efficiency practices, and N efficiency practices) are summarized below and provided in Attachment 1 (Excel workbook format).

6.1 IRRIGATION METHOD

For primary irrigation method, drip was the most common, comprising 31% of the acres and 28% of the fields (Table 13). The next most common were micro-sprinkler (23% of acres), flood (18% of acres) and sprinkler (17% of acres). The least used methods were furrow, border strip, and sub-irrigation. Secondary irrigation was reported for 14% of acres with the most common methods being sprinkler (4.5% of acres) and drip (4% of acres).

Table 13. Irrigation method summary.

Irrigation Type	Primary Method		Secondary Method	
	Acres	Fields	Acres	Fields
Drip	339,443 (31%)	7,046	43,859	1,024
Micro Sprinkler	255,634 (23%)	6,073	27,182	683
Furrow	80,573 (7%)	1,737	7,718	142
Sprinkler	185,340 (17%)	5,113	49,754	1,244
Border Strip	15,094 (1.4%)	317	5,370	109
Flood	195,276 (18%)	3,748	24,566	633
Sub-irrigation	9,916 (0.90%)	135	2,084	62

6.2 IRRIGATION AND NITROGEN EFFICIENCY PRACTICES

The N efficiency practices reported by members are shown in Table 14. The most common practices were soil nutrient testing (25% of acres), petiole tissue testing (22% of acres), fertigation (19% of acres), and irrigation water N testing (15% of acres). For the least common practices, cover crops are not practical on every field, and variable rate fertilization requires specialized equipment, data, and interpretation to execute.

Irrigation management efficiency practices are shown in Table 15. This data reflects the increasing availability and data accessibility of technologies to improve irrigation efficiency such as drip irrigation, laser leveling, ET-based irrigation scheduling, and the use of moisture probes.

Table 14. N management efficiency practices reported by members for 2021 CY.

N Efficiency Practice	Irrigated Crop Acreage	Number of Fields
Cover crops	217,236 (8%)	5,172
Fertigation	538,167 (19%)	10,474
Foliar N applications	284,446 (10%)	5,742
Irrigation water N testing	423,033 (15%)	7,907
Soil nutrient testing	708,867 (25%)	14,402
Petiole tissue	635,762 (22%)	13,537
Variable rate fertilizer application	20,116 (1%)	301

Table 15. Irrigation management efficiency practices reported by members for 2021 CY.

Irrigation Efficiency Practice	Irrigated Crop Acreage	Number of Fields
Laser leveling	583,479 (20%)	12,120
Use of ET in irrigation scheduling	542,305 (19%)	10,712
Water application scheduled to need	997,204 (34%)	22,111
Use of moisture probe	441,083 (15%)	9,000
Soil moisture neutron probe	77,827 (3%)	1,720
Pressure bomb	266,498 (9%)	5,173

6.3 Management Practice Implementation Report

The MPIR is required to be completed by members in a surface water quality management plan (SQMP) or groundwater quality management plan (GQMP) area to identify management practices implemented by members to comply with the SQMP and GQMP requirements. MPIR implementation data in Excel workbook format from the most recently submitted MPIR is due the RWQCB by November 30 annually. The 2020 CY MPIR spreadsheet was submitted with the Nov. 2021 Annual Management Practices Report (SVWQC, 2021).

For the 2021 CY there was no groundwater MPIR data collected per the RWQCB letter sent on August 26, 2021, which stated the groundwater MPIR should be completed every third year beginning in 2021; thus, the next groundwater MPIR data will be submitted in 2024 for the 2023 CY. The surface water MPIR data for Ulatis Creek is provided in Attachment 1. There was no data collected for Gilsizer Slough since the Surface Water Management Plan was deemed complete in the RWQCB letter sent on July 7, 2022.

7 REFERENCES

CH2M Hill. 2014. Sacramento Valley Water Quality Coalition groundwater quality assessment report. Northern California Water Association. June 2014.

CH2M Hill. 2016. Groundwater quality assessment report. Northern California Water Association. January 2016.

Geisseler, D. 2021. Nitrogen concentrations in harvested plant parts – Update 03/2021. http://geisseler.ucdavis.edu/Geisseler_Report_U1_2021_03_31.pdf

Geisseler, D., Smith R., Cahn, M., Muramoto, J. 2021. Nitrogen mineralization from organic fertilizers and composts: Literature survey and model fitting. Journal of Environmental Quality. 50:1325-1338. DOI: 10.1002/jeq2.20295

Hubert, M. and Vandervieren, E. 2008. An adjusted boxplot for skewed distributions. Computational Statistics & Data Analysis. 52(12):5186-5201. DOI: 10.1016/j.csda.2007.11.008

SVWQC. 2021. Annual management practice implementation and nitrogen management report – 2020 crop year. Sacramento Valley Water Quality Coalition. November 2021.

Tukey. J.W. 1977. Exploratory data analysis. Addison-Wesley, Reading MA.

APPENDICES

Appendix A: INMP Summary Statistics by Crop

Appendix B: Example INMP Member Feedback Report

Appendix C: INMP Statistical Groupings and Exclusion Thresholds by Crop

APPENDIX A

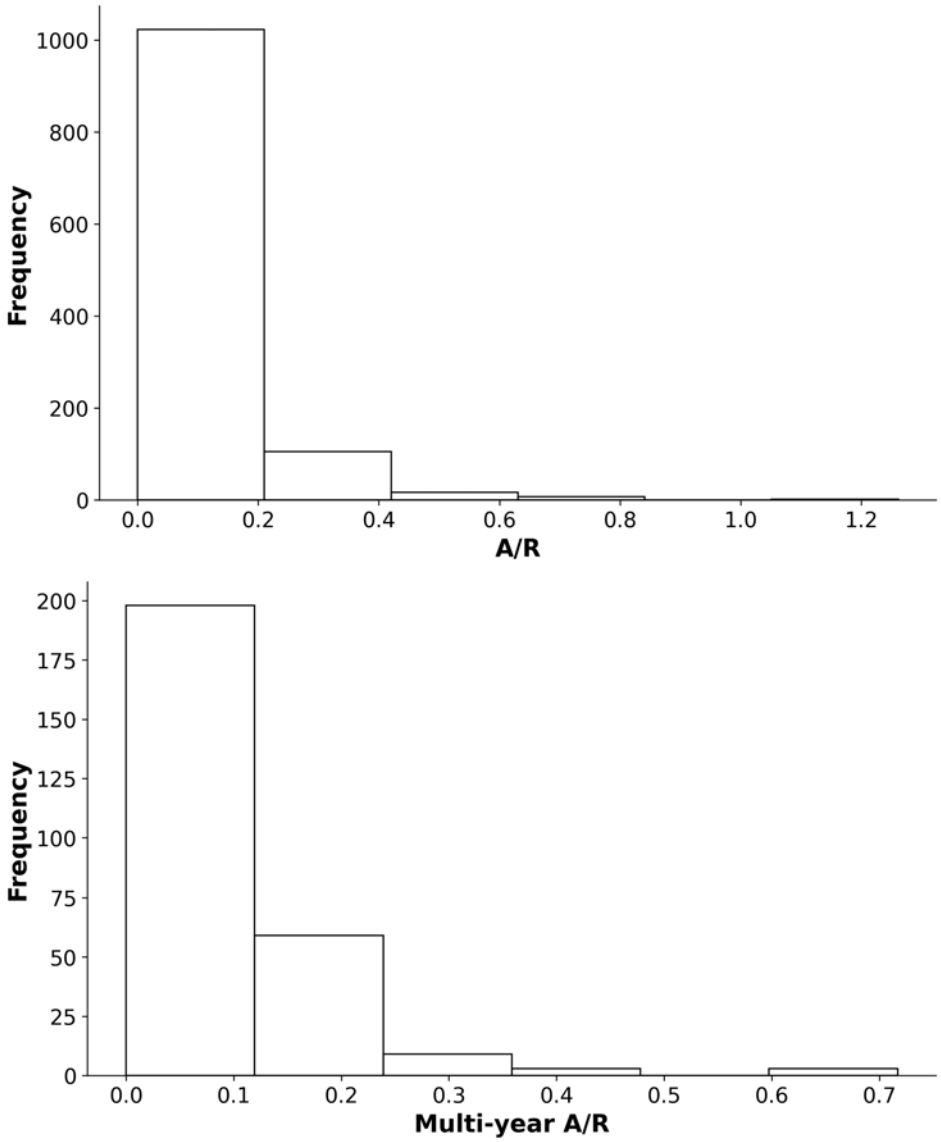
INMP SUMMARY STATISTICS BY CROP

1. ALFALFA - HAY

Table 1-1. Summary statistics for ALFALFA - HAY fields in Coalition.

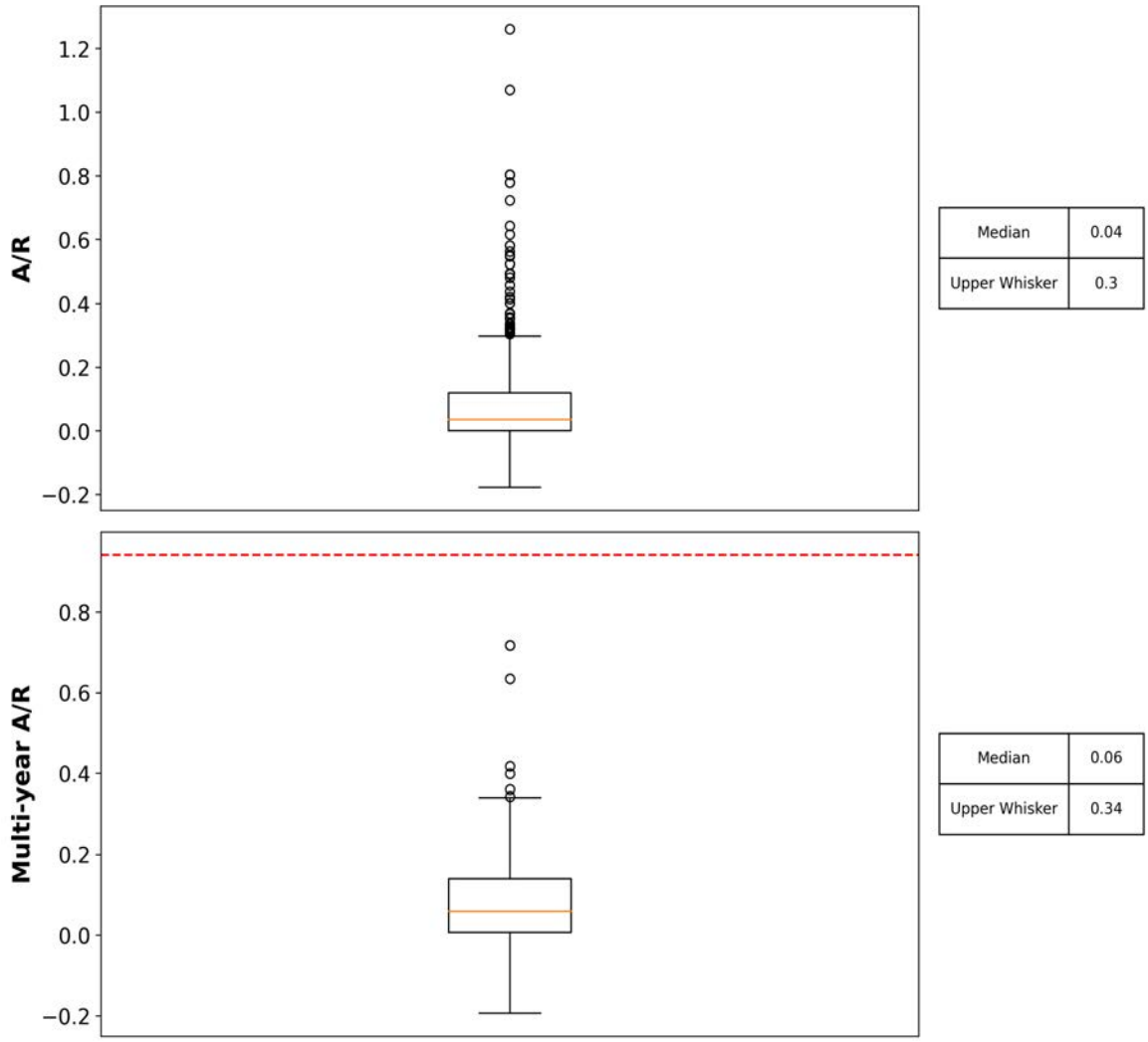
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	1153	62314.89	0.09	0.2	0.0	4.27	--	--
A-R	1153	62314.89	-337.65	132.75	-747.6	244.24	--	--
Multi-year A/R	272	13805.23	0.09	0.1	0.0	0.72	0.94	0
Multi-year A-R	272	13805.23	-1076.46	317.39	-1716.65	-168.35	--	--

Figure 1-1. Histogram of A/R for ALFALFA - HAY fields in the Coalition.



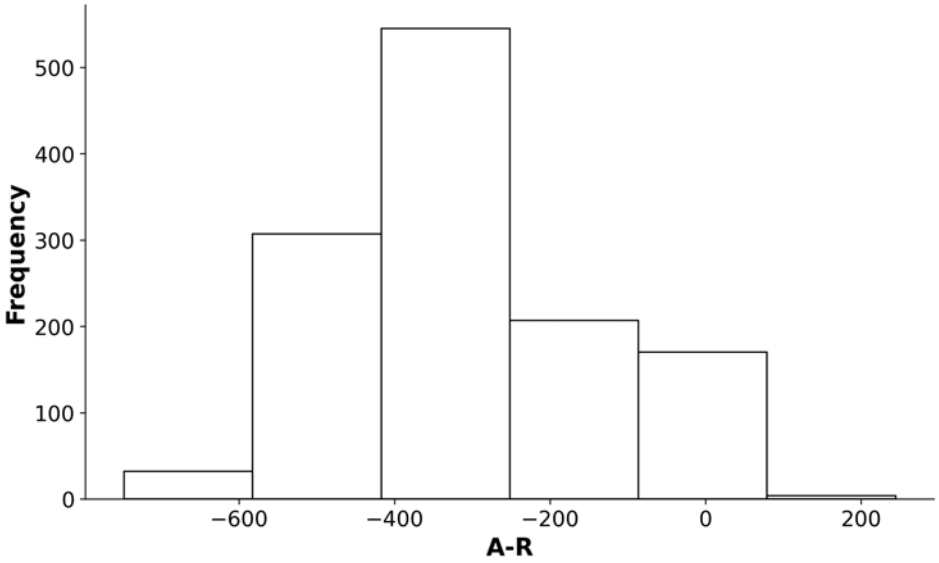
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 1-2. Box and whisker plot of A/R for ALFALFA - HAY fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 1-3. Histogram of A-R for ALFALFA - HAY fields in the Coalition.



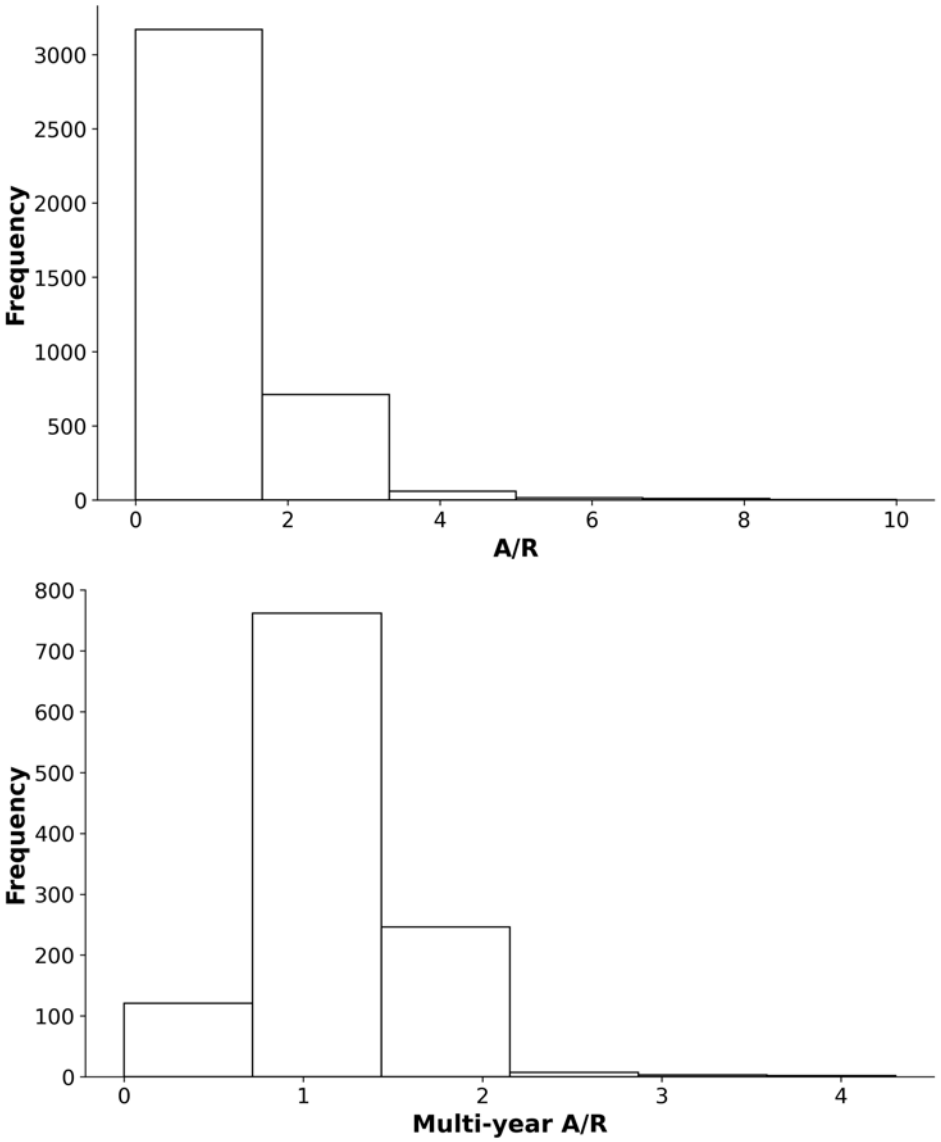
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

2. ALMOND

Table 2-1. Summary statistics for ALMOND fields in Coalition.

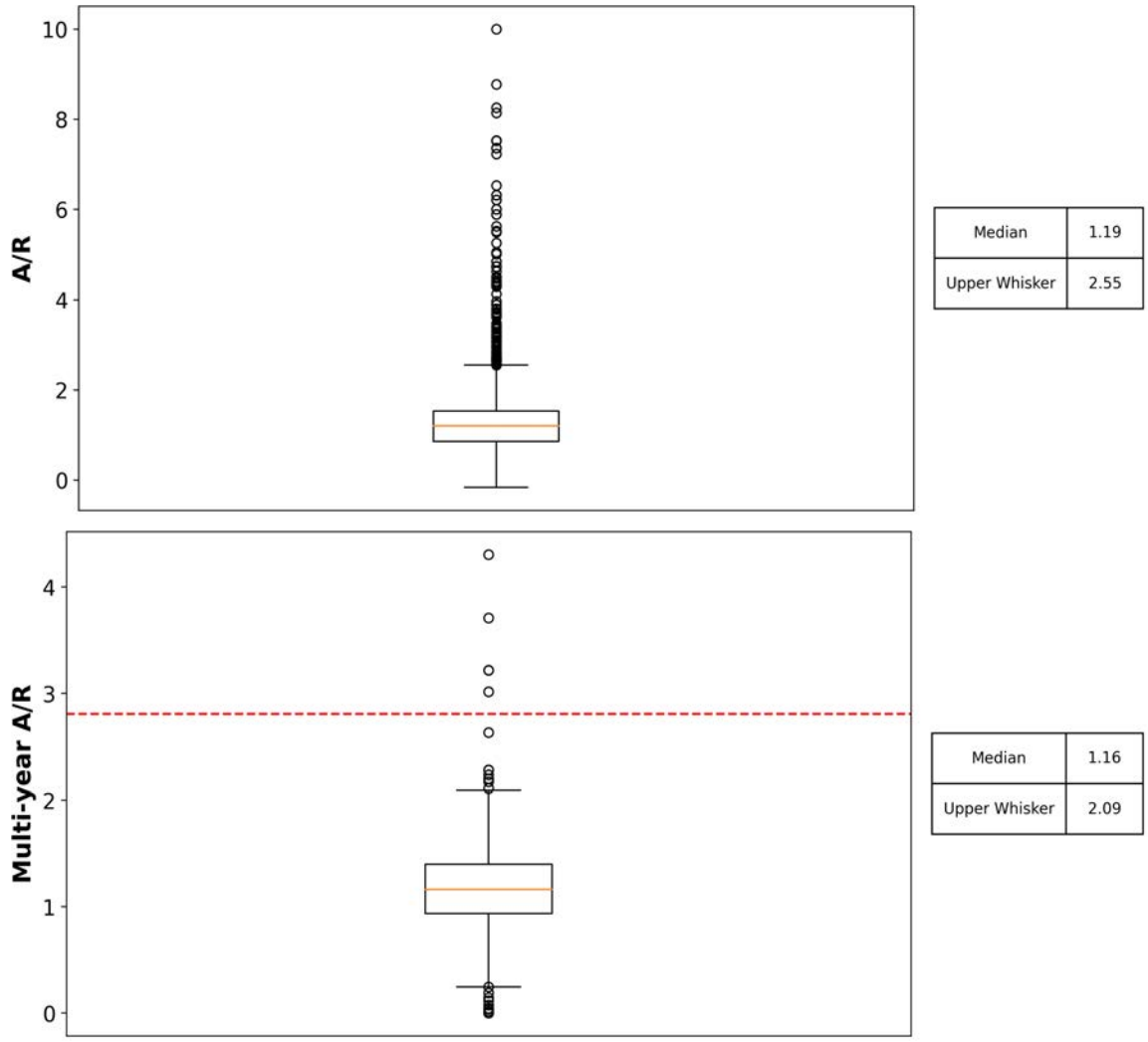
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	3951	197111.19	1.32	1.11	0.0	29.41	--	--
A-R	3951	197111.19	19.73	72.45	-627.28	332.0	--	--
Multi-year A/R	1141	52974.92	1.17	0.41	0.0	4.3	2.8	5
Multi-year A-R	1141	52974.92	54.18	144.17	-894.1	998.0	--	--

Figure 2-1. Histogram of A/R for ALMOND fields in the Coalition.



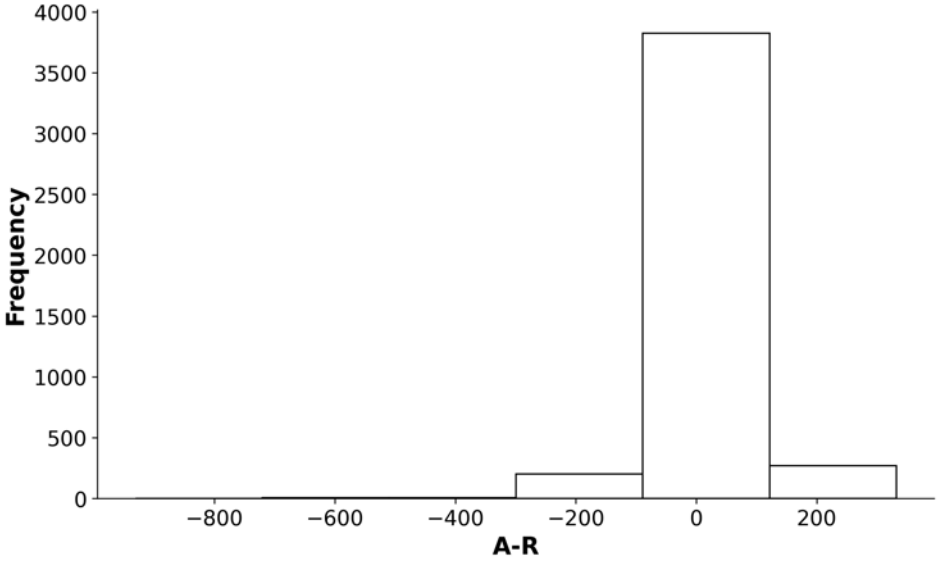
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 2-2. Box and whisker plot of A/R for ALMOND fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 2-3. Histogram of A-R for ALMOND fields in the Coalition.



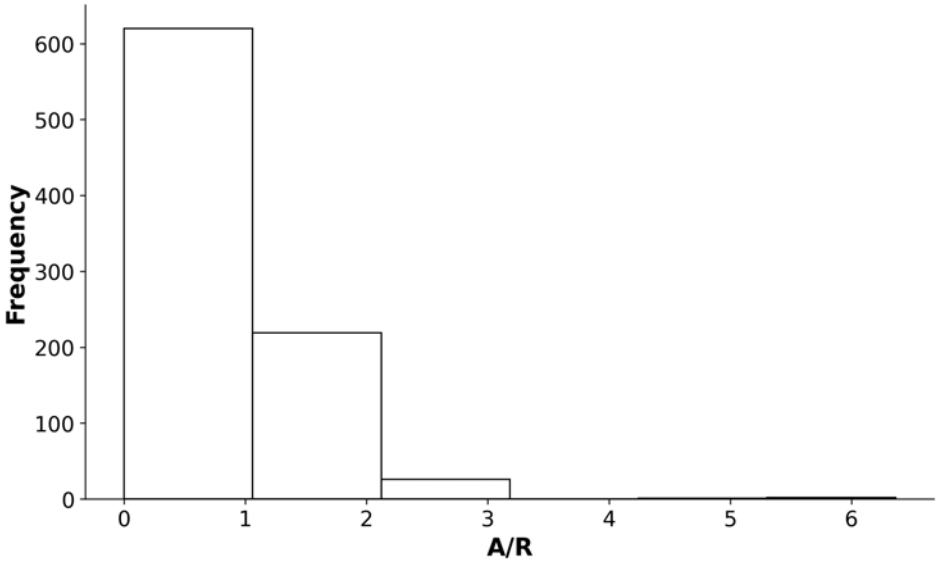
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

3. ALMOND-YOUNG

Table 3-1. Summary statistics for ALMOND-YOUNG fields in Coalition.

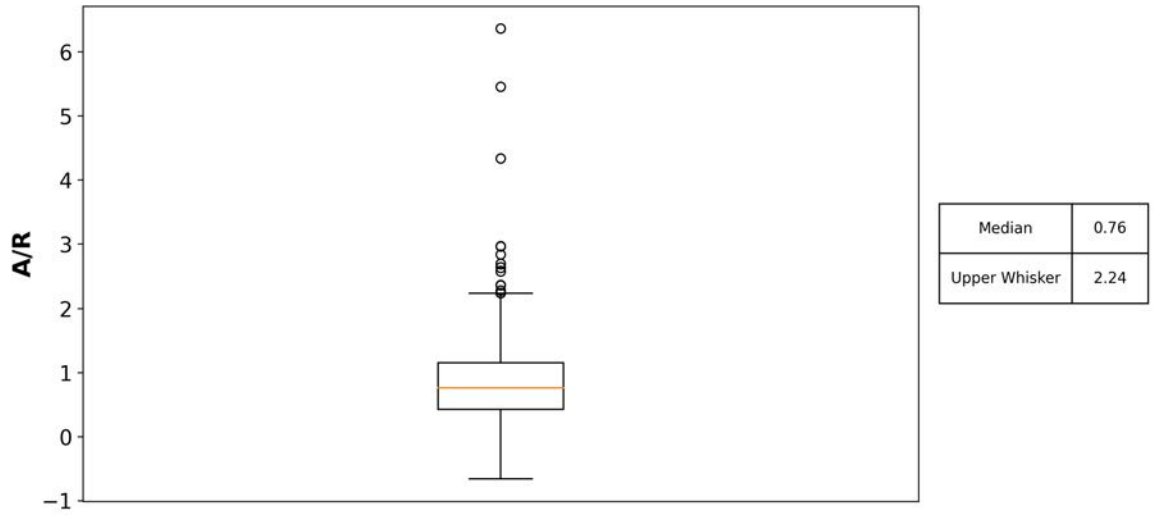
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	525	28080.32	0.84	0.44	0.0	2.63	--	--
A-R	525	28080.32	-28.54	63.81	-191.64	216.48	--	--

Figure 3-1. Histogram of A/R for ALMOND-YOUNG fields in the Coalition.



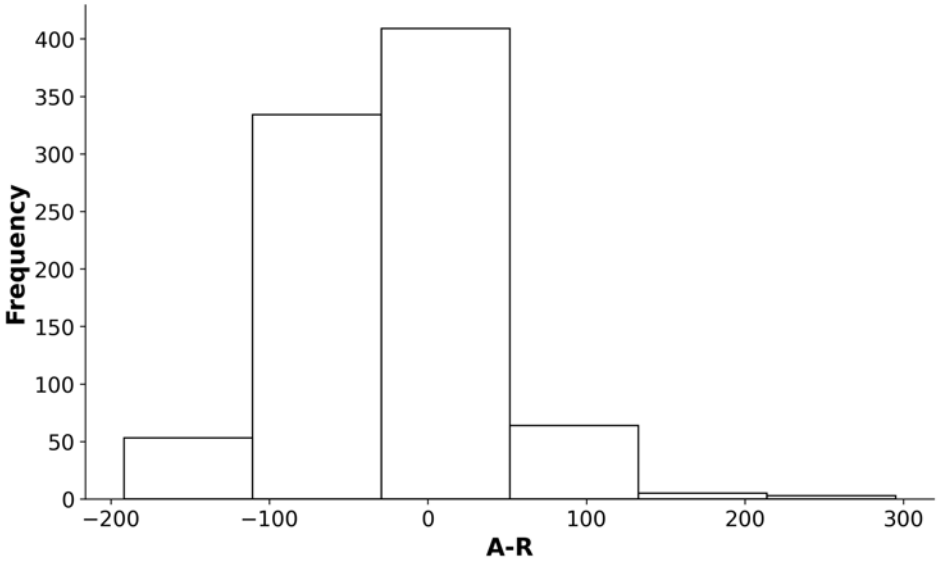
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 3-2. Box and whisker plot of A/R for ALMOND-YOUNG fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 3-3. Histogram of A-R for ALMOND-YOUNG fields in the Coalition.



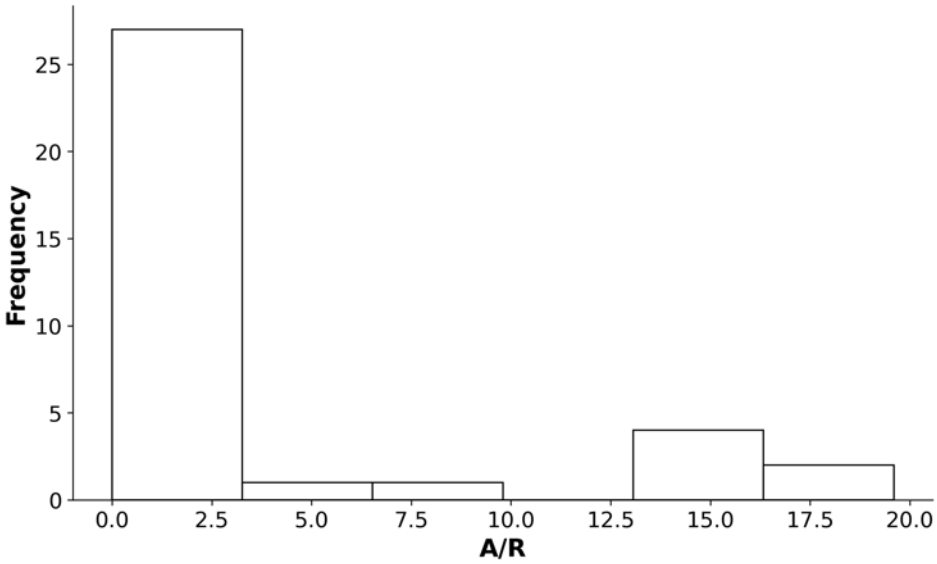
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

4. APPLE

Table 4-1. Summary statistics for APPLE fields in Coalition.

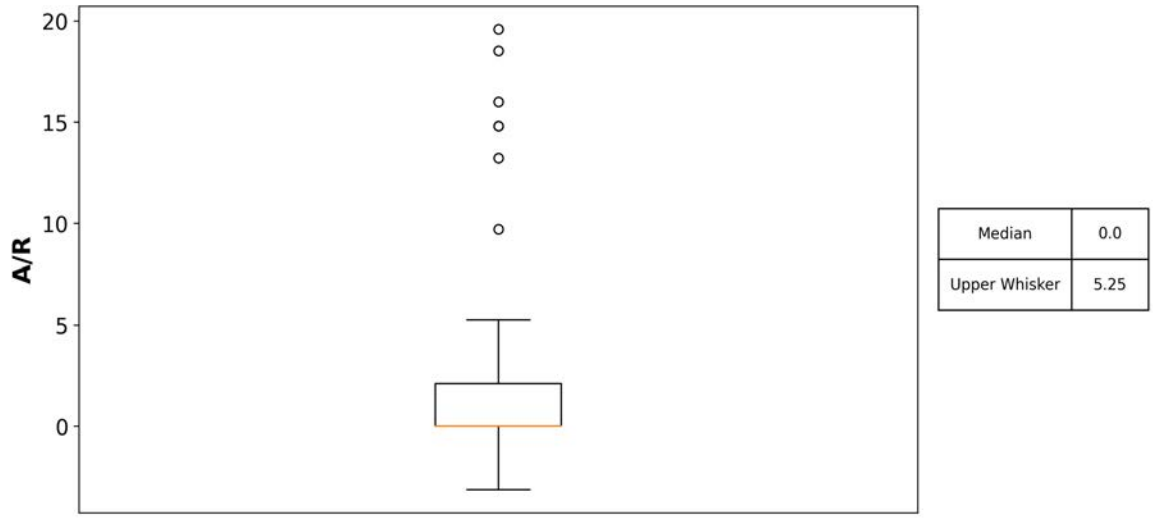
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	31	401.69	3.7	6.55	0.0	19.6	--	--
A-R	31	401.69	10.07	36.54	-34.56	92.44	--	--
Multi-year A/R	4	56.6	6.99	7.22	2.97	17.81	--	--
Multi-year A-R	4	56.6	127.62	72.19	53.08	226.52	--	--

Figure 4-1. Histogram of A/R for APPLE fields in the Coalition.



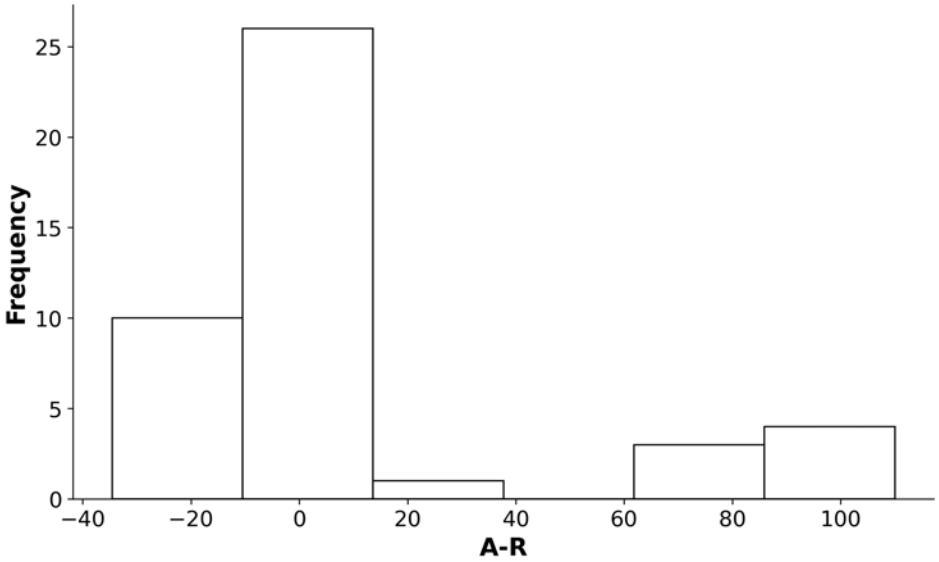
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 4-2. Box and whisker plot of A/R for APPLE fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 4-3. Histogram of A-R for APPLE fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

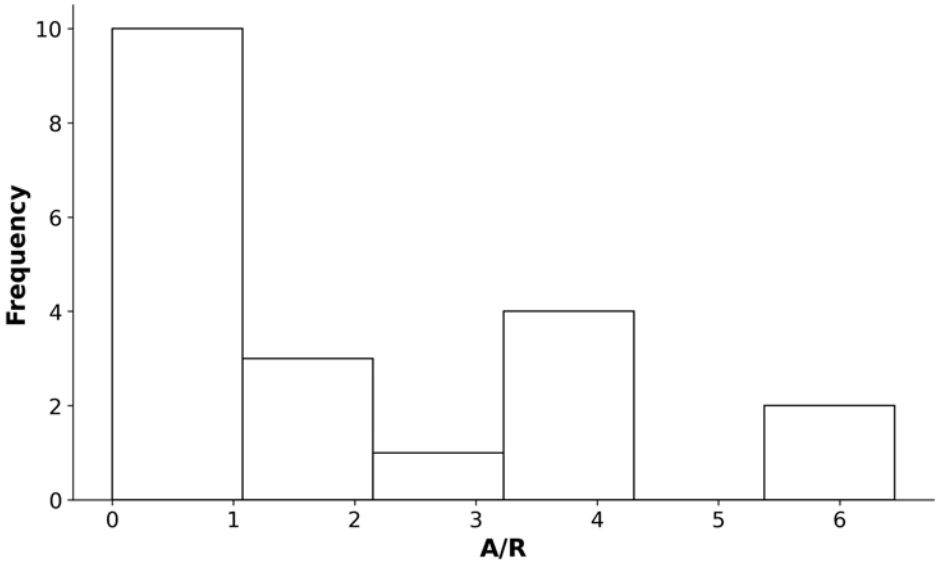
5. BARLEY - GRAIN

Table 5-1. Summary statistics for BARLEY - GRAIN fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	20	898.8	1.96	1.94	0.0	6.45	6.64	0
A-R	20	898.8	13.81	73.61	-151.2	152.11	--	--

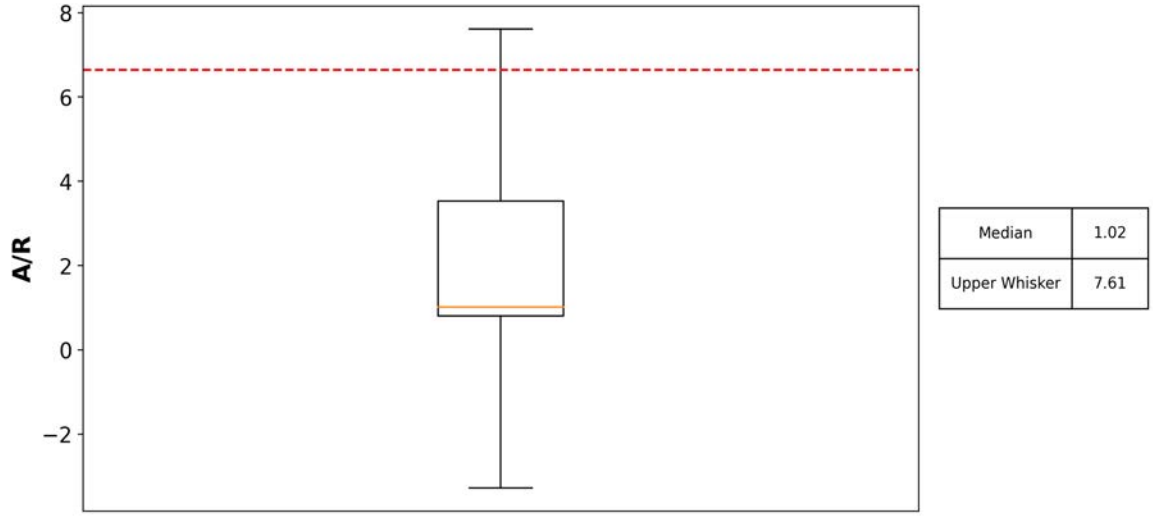
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 5-1. Histogram of A/R for BARLEY - GRAIN fields in the Coalition.



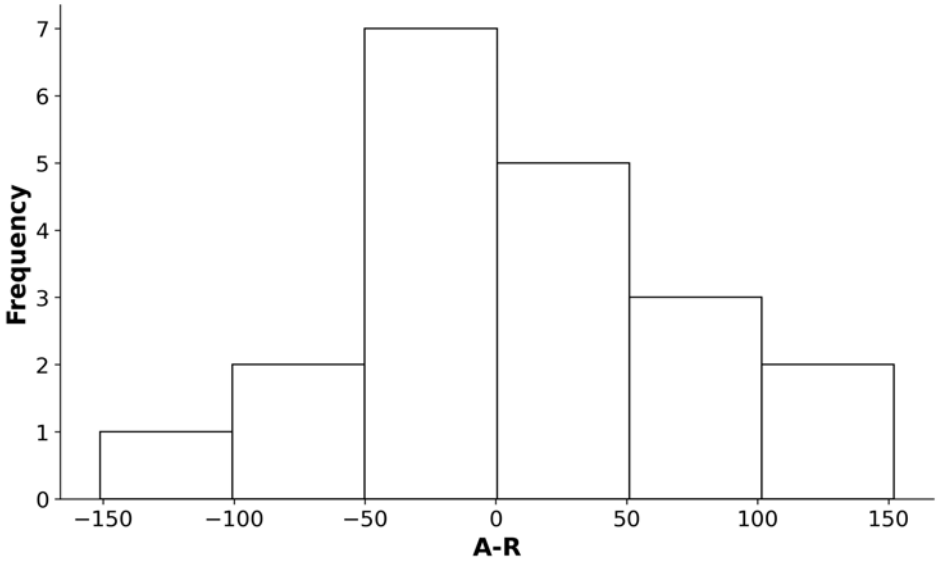
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 5-2. Box and whisker plot of A/R for BARLEY - GRAIN fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 5-3. Histogram of A-R for BARLEY - GRAIN fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

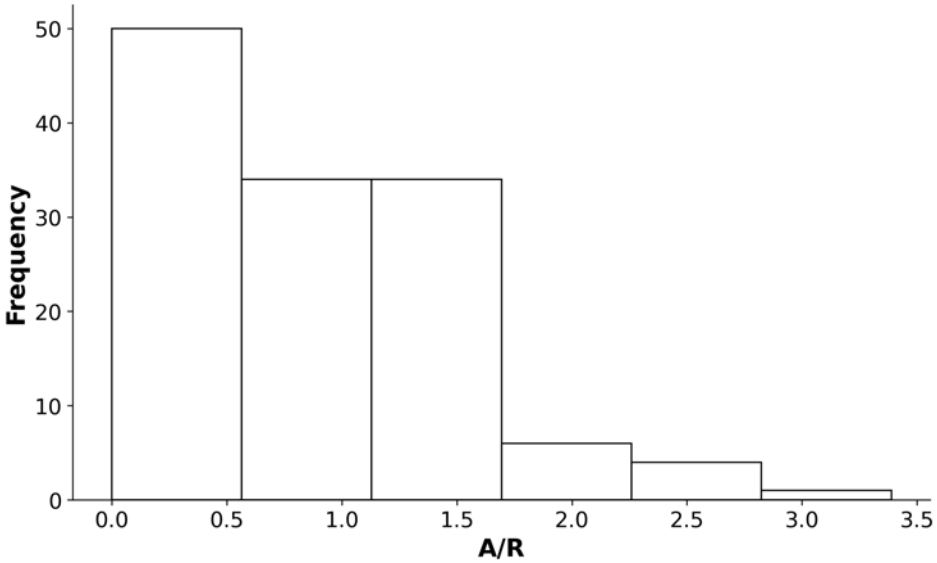
6. BEAN DRY

Table 6-1. Summary statistics for BEAN DRY fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	129	5531.46	0.83	0.7	0.0	3.39	2.95	0
A-R	129	5531.46	-12.52	49.41	-106.25	106.71	--	--

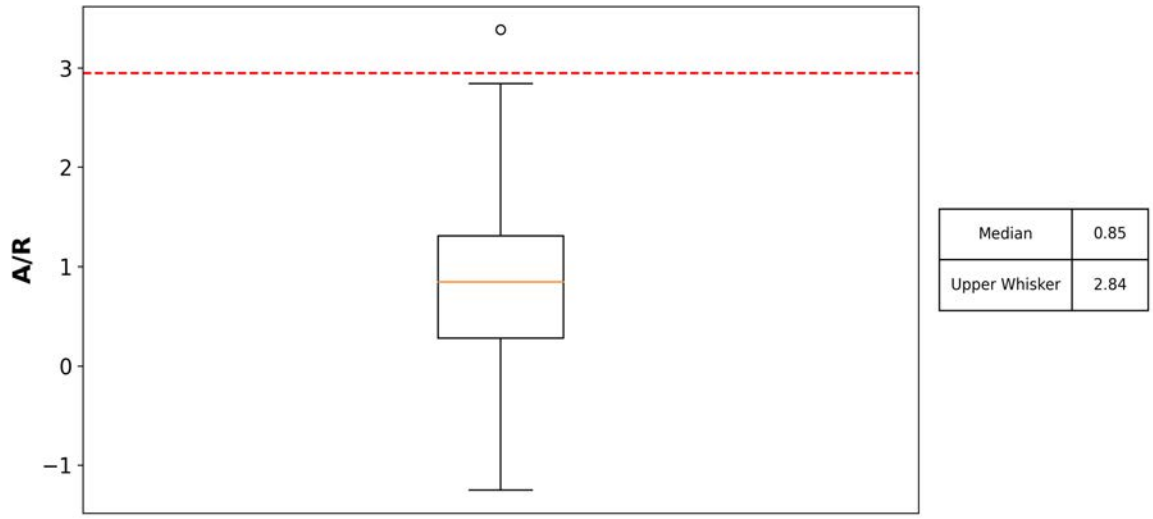
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 6-1. Histogram of A/R for BEAN DRY fields in the Coalition.



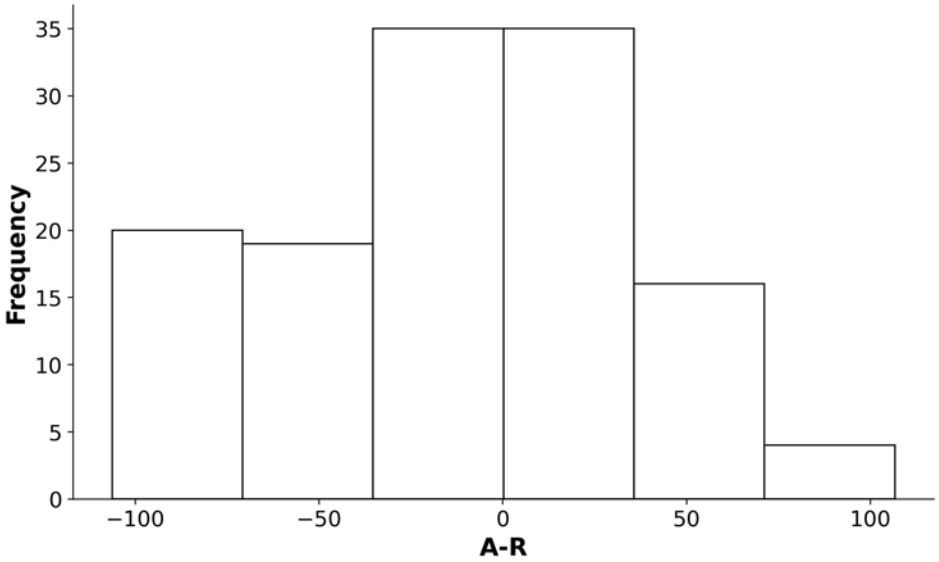
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 6-2. Box and whisker plot of A/R for BEAN DRY fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 6-3. Histogram of A-R for BEAN DRY fields in the Coalition.



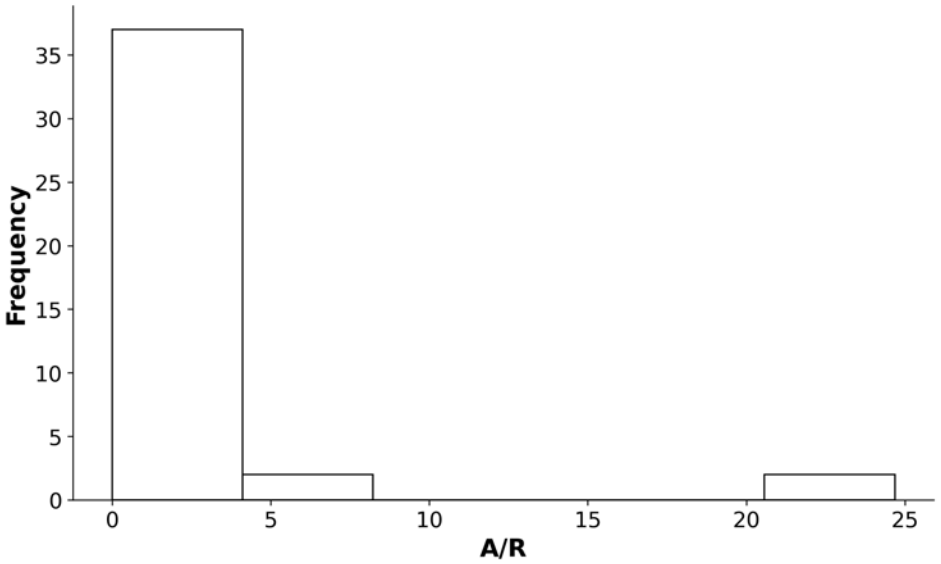
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

7. CHERRY

Table 7-1. Summary statistics for CHERRY fields in Coalition.

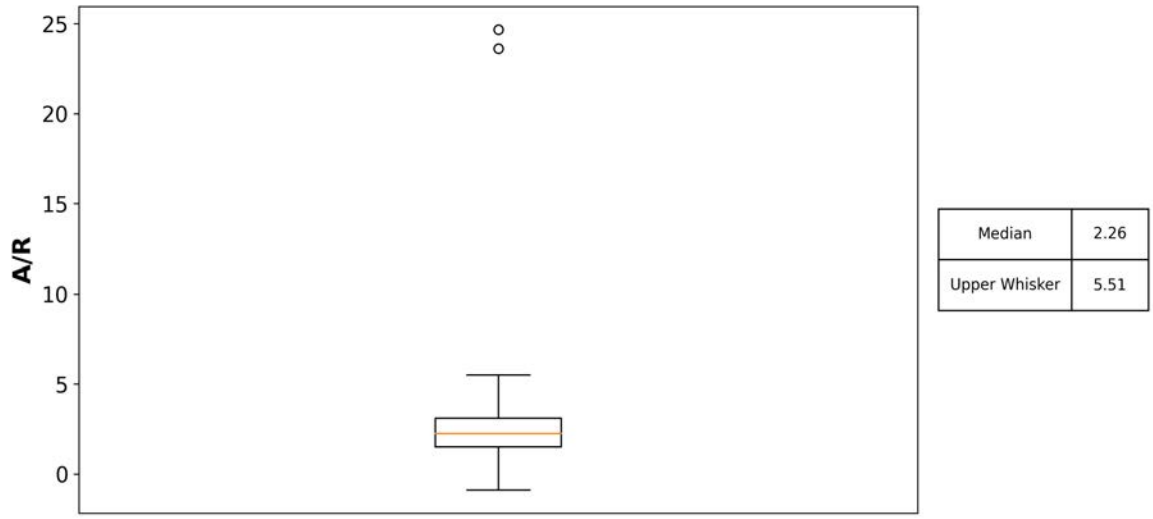
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	40	1423.5	2.6	3.64	0.0	23.63	--	--
A-R	40	1423.5	21.88	25.57	-12.77	113.01	--	--
Multi-year A/R	17	779.0	4.32	3.56	0.46	17.15	--	--
Multi-year A-R	17	779.0	109.01	59.41	-8.1	260.91	--	--

Figure 7-1. Histogram of A/R for CHERRY fields in the Coalition.



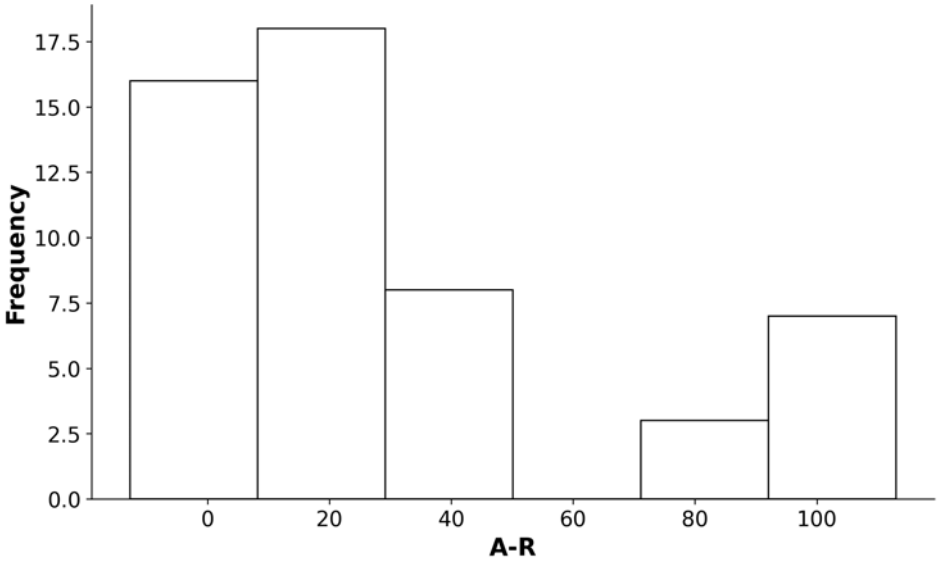
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 7-2. Box and whisker plot of A/R for CHERRY fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 7-3. Histogram of A-R for CHERRY fields in the Coalition.



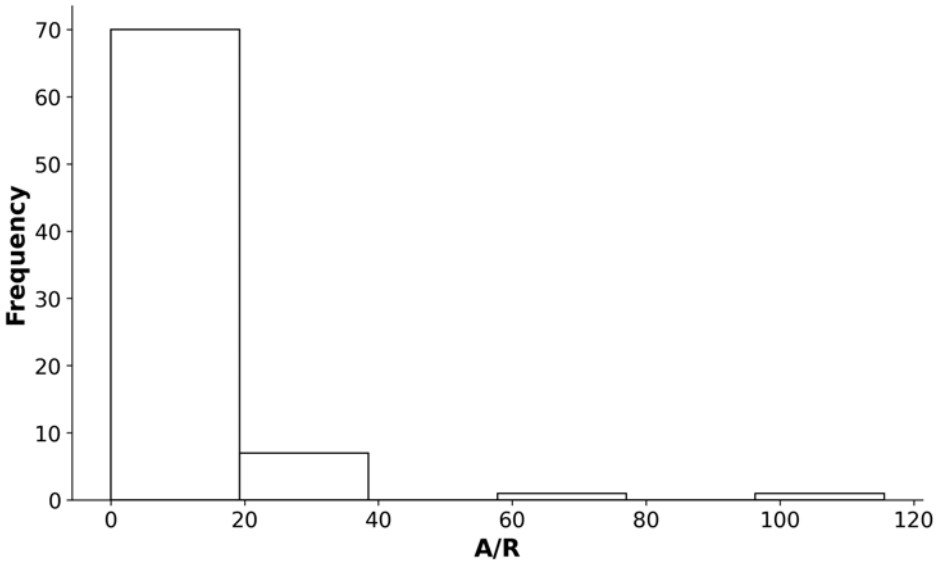
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

8. CITRUS

Table 8-1. Summary statistics for CITRUS fields in Coalition.

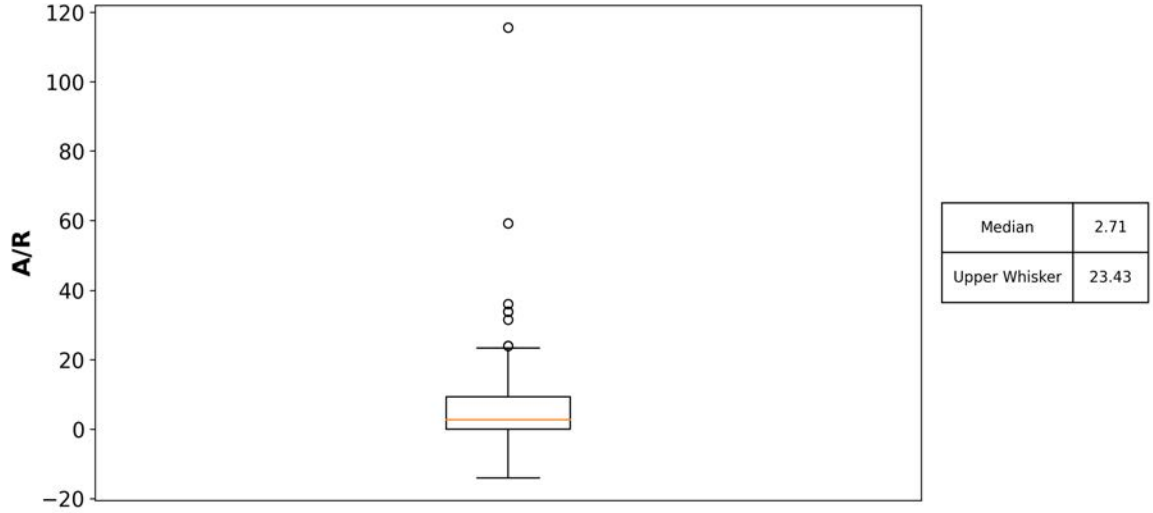
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	77	512.22	8.23	16.42	0.0	115.57	--	--
A-R	77	512.22	50.55	79.77	-44.4	340.78	--	--
Multi-year A/R	13	209.79	8.63	4.3	4.74	18.41	--	--
Multi-year A-R	13	209.79	348.84	275.32	97.22	821.51	--	--

Figure 8-1. Histogram of A/R for CITRUS fields in the Coalition.



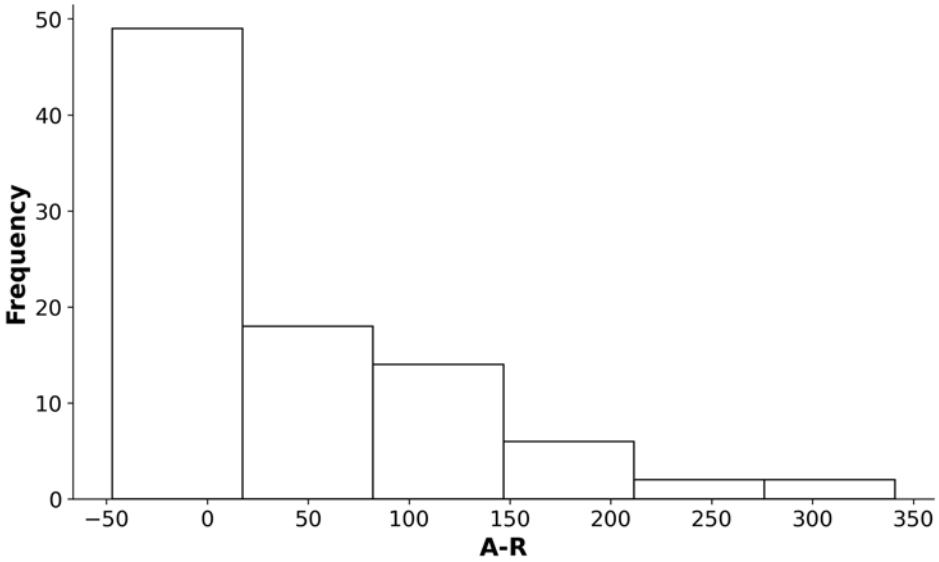
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 8-2. Box and whisker plot of A/R for CITRUS fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 8-3. Histogram of A-R for CITRUS fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

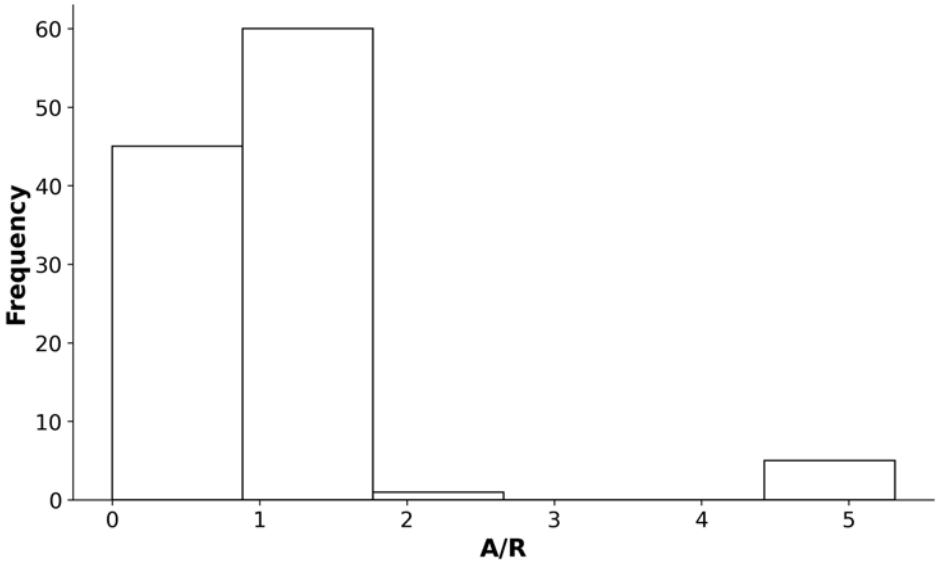
9. CORN - FODDER/SILAGE

Table 9-1. Summary statistics for CORN - FODDER/SILAGE fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	114	6087.46	2.28	7.02	0.0	44.44	2.24	3
A-R	114	6087.46	4.62	77.94	-150.6	245.35	--	--

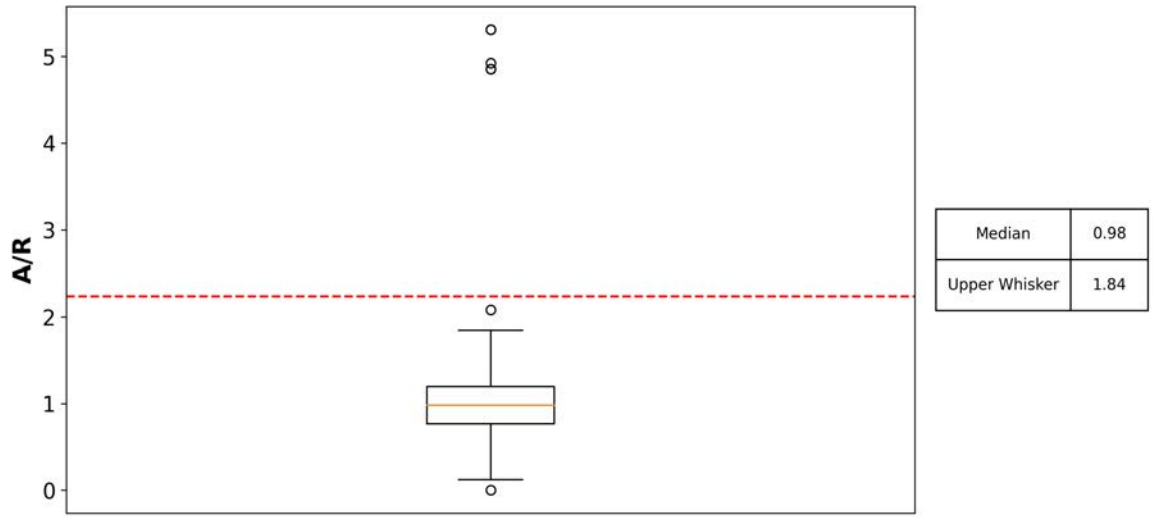
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 9-1. Histogram of A/R for CORN - FODDER/SILAGE fields in the Coalition.



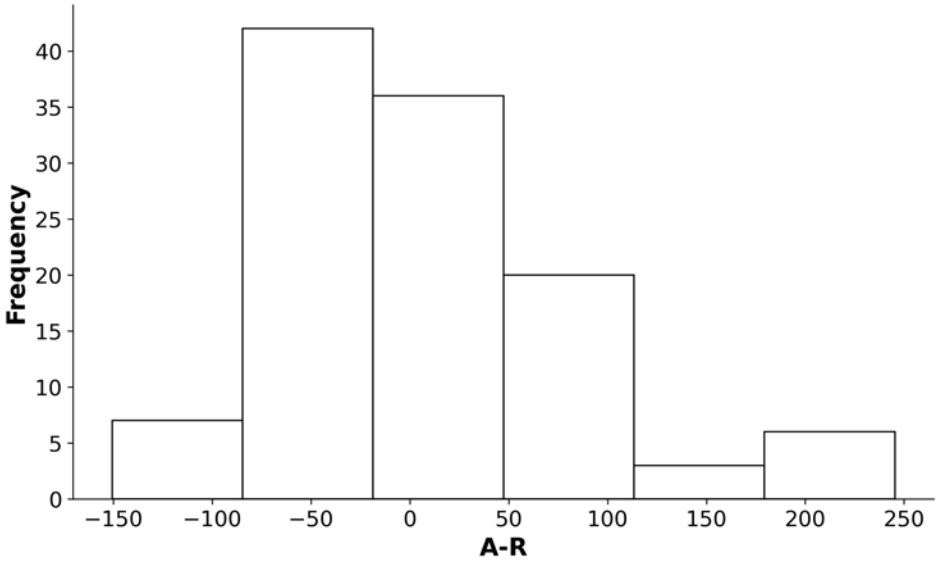
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 9-2. Box and whisker plot of A/R for CORN - FODDER/SILAGE fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 9-3. Histogram of A-R for CORN - FODDER/SILAGE fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

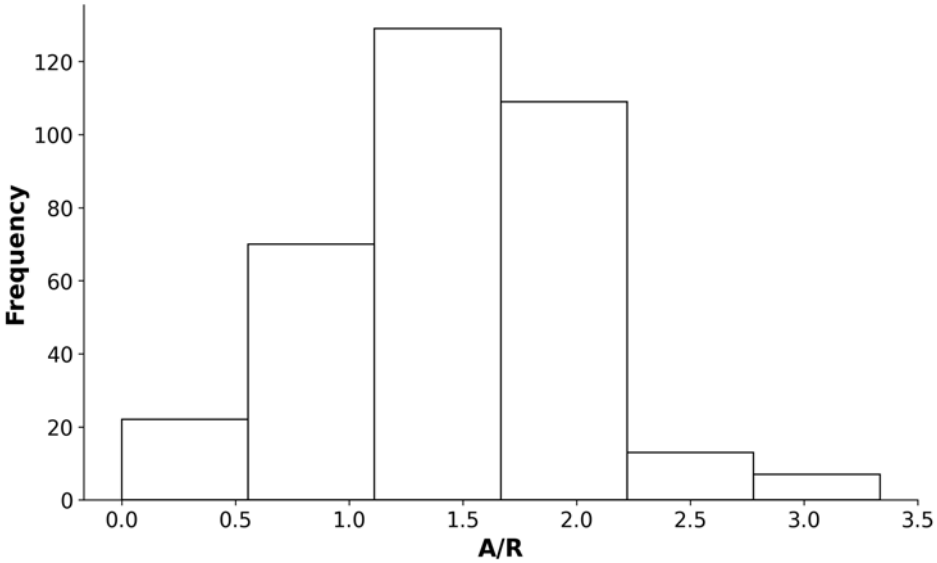
10. CORN - GRAIN

Table 10-1. Summary statistics for CORN - GRAIN fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	352	23355.27	1.52	1.35	0.0	21.36	2.3	9
A-R	352	23355.27	63.05	82.41	-144.0	276.96	--	--

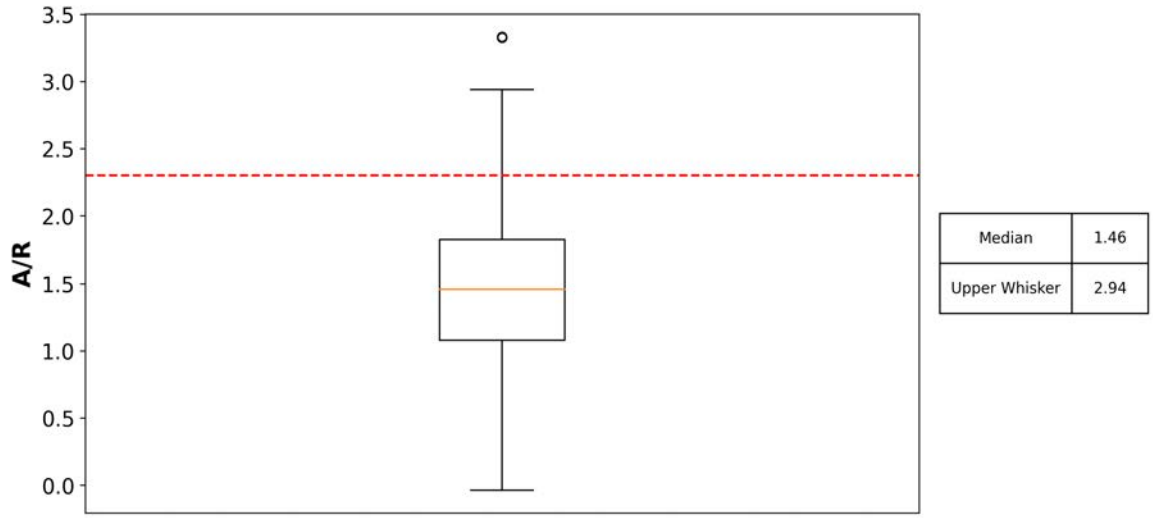
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 10-1. Histogram of A/R for CORN - GRAIN fields in the Coalition.



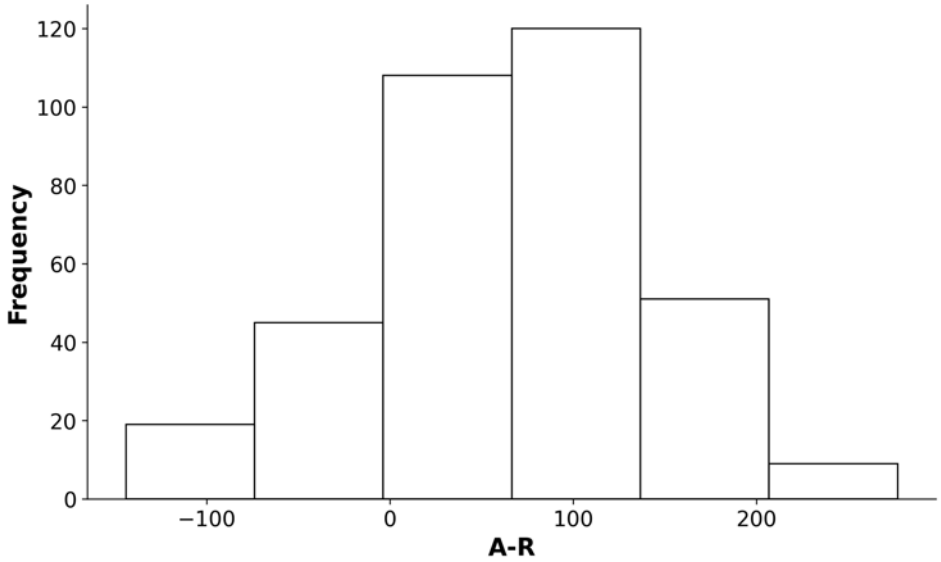
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 10-2. Box and whisker plot of A/R for CORN - GRAIN fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 10-3. Histogram of A-R for CORN - GRAIN fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

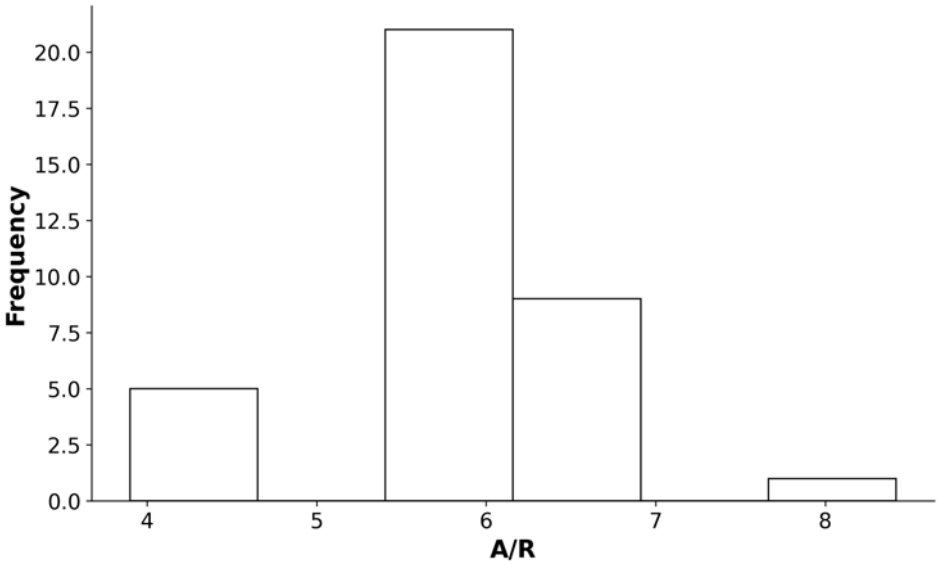
11. CUCUMBER

Table 11-1. Summary statistics for CUCUMBER fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	36	1307.79	5.77	0.79	3.9	8.42	9.44	0
A-R	36	1307.79	82.32	9.08	59.48	109.48	--	--

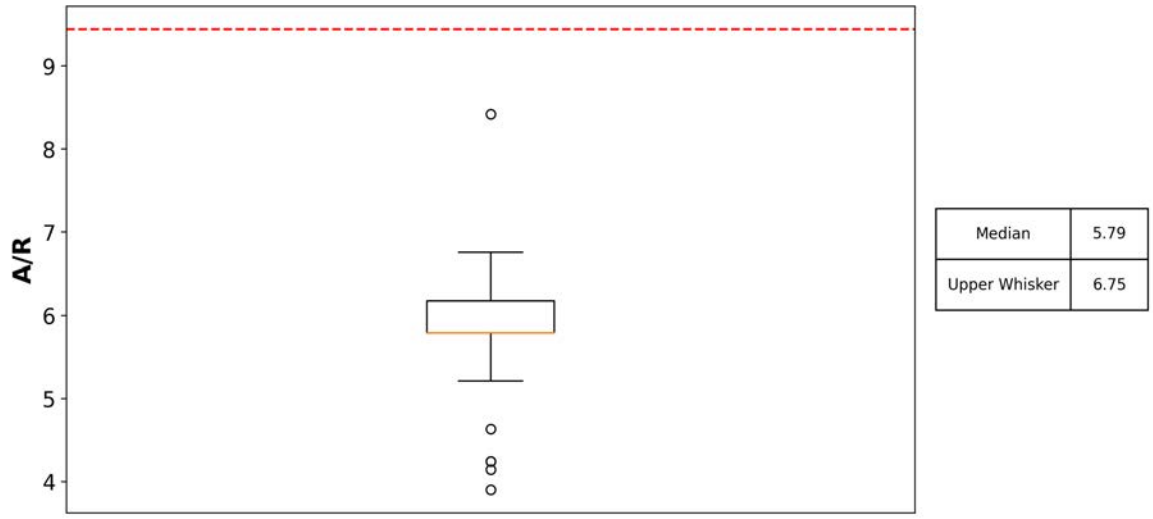
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 11-1. Histogram of A/R for CUCUMBER fields in the Coalition.



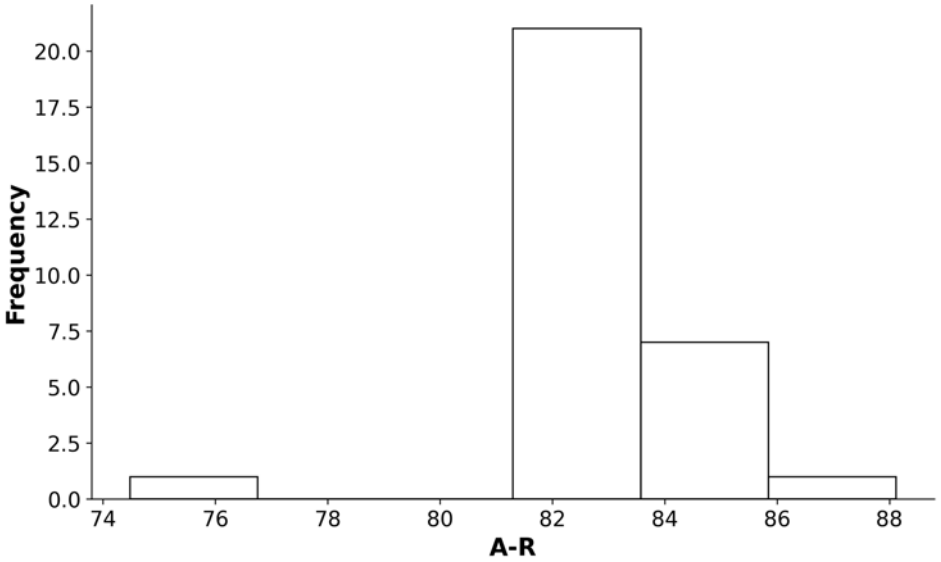
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 11-2. Box and whisker plot of A/R for CUCUMBER fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 11-3. Histogram of A-R for CUCUMBER fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

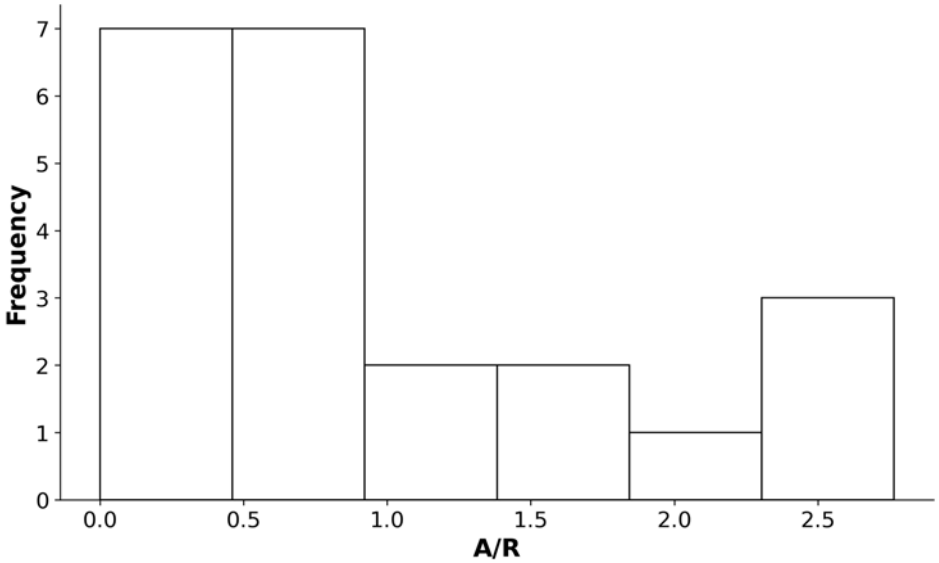
12. GRAIN HAY

Table 12-1. Summary statistics for GRAIN HAY fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	22	833.41	0.94	0.9	0.0	2.76	1.6	0
A-R	22	833.41	-14.82	70.04	-217.0	76.6	--	--

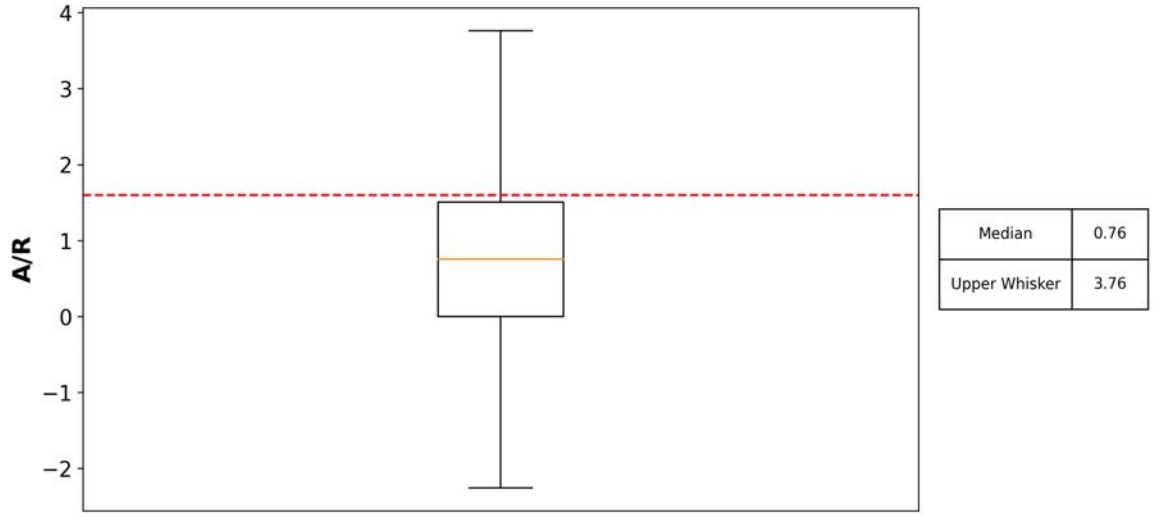
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 12-1. Histogram of A/R for GRAIN HAY fields in the Coalition.



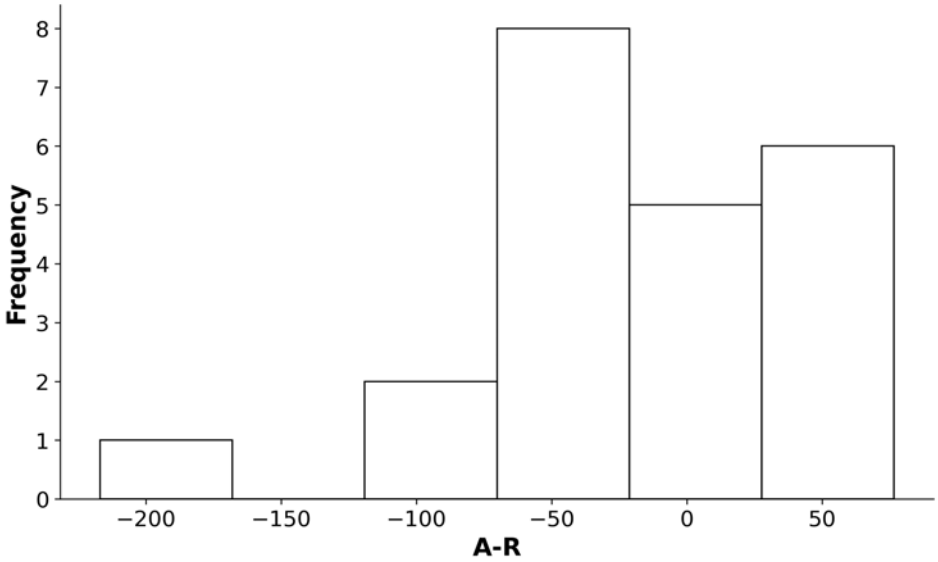
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 12-2. Box and whisker plot of A/R for GRAIN HAY fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 12-3. Histogram of A-R for GRAIN HAY fields in the Coalition.



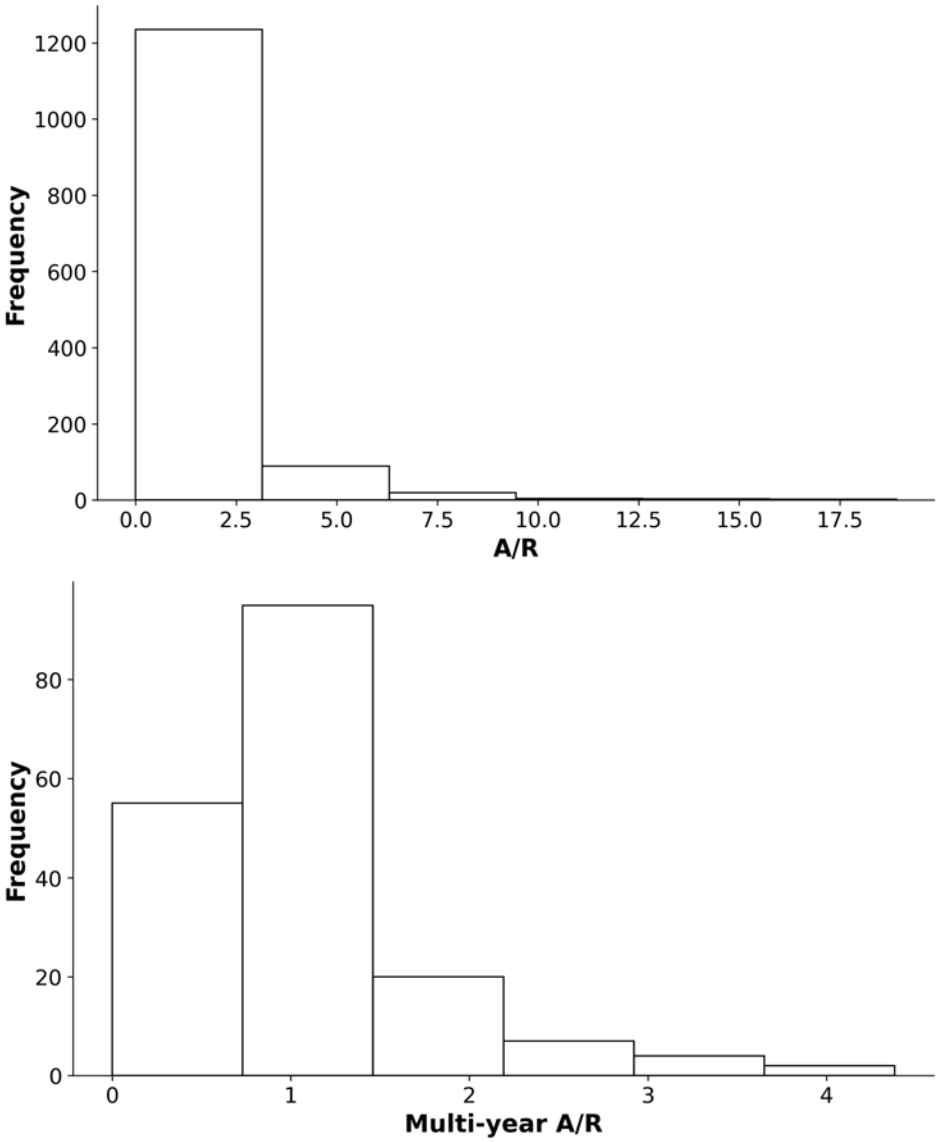
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

13. GRAPE - WINE

Table 13-1. Summary statistics for GRAPE - WINE fields in Coalition.

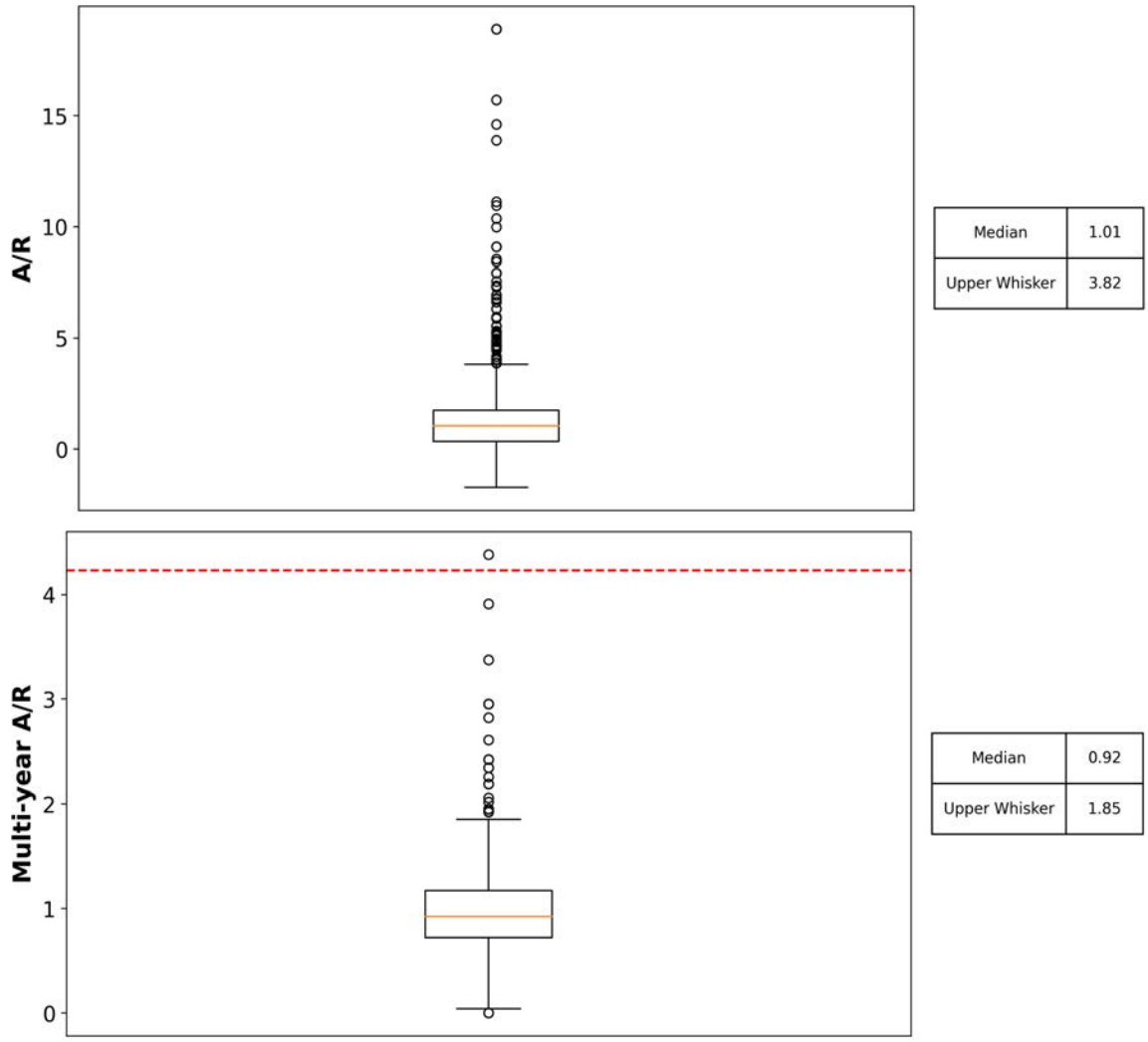
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	1367	65887.78	2.62	17.41	0.0	555.56	--	--
A-R	1367	65887.78	6.36	29.5	-72.0	334.4	--	--
Multi-year A/R	183	12447.75	1.07	0.68	0.0	4.38	4.23	1
Multi-year A-R	183	12447.75	4.8	54.01	-103.4	224.8	--	--

Figure 13-1. Histogram of A/R for GRAPE - WINE fields in the Coalition.



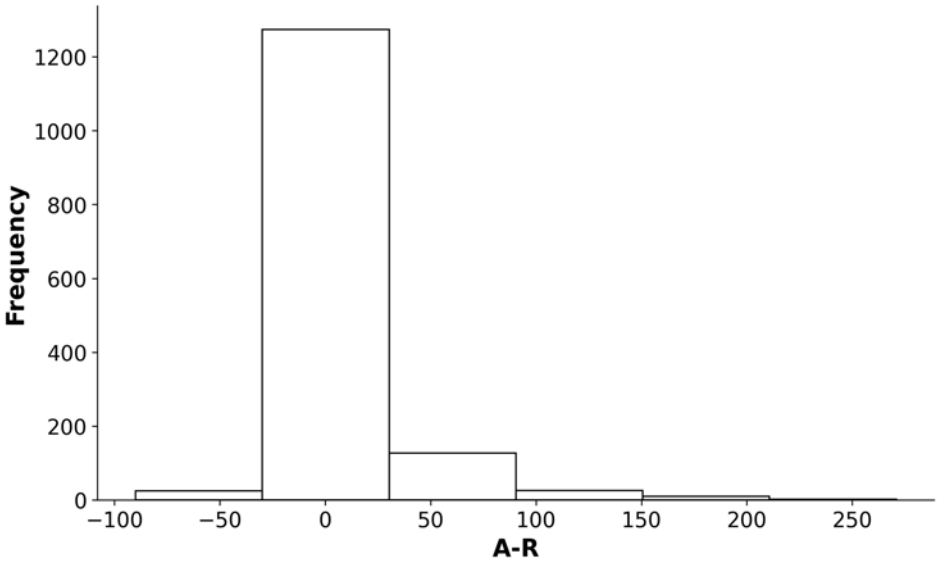
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 13-2. Box and whisker plot of A/R for GRAPE - WINE fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 13-3. Histogram of A-R for GRAPE - WINE fields in the Coalition.



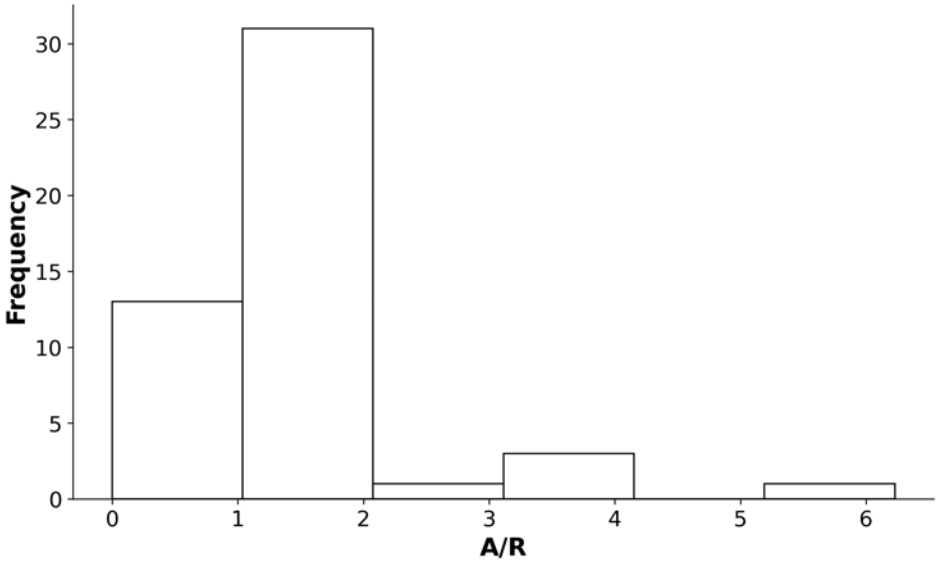
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

14. GRAPE - WINE-YOUNG

Table 14-1. Summary statistics for GRAPE - WINE-YOUNG fields in Coalition.

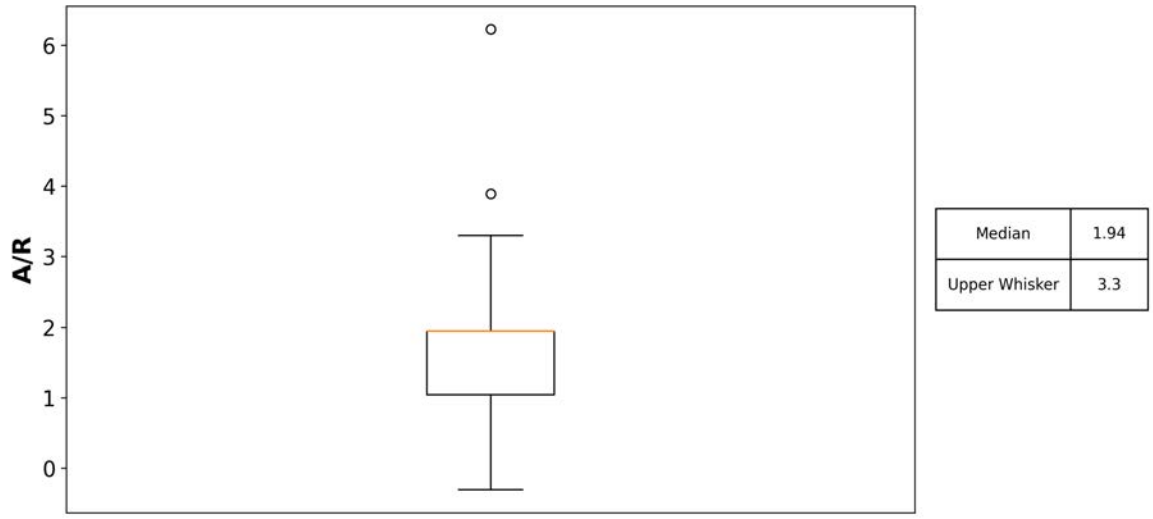
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	53	3209.45	3.54	6.83	0.0	29.86	--	--
A-R	53	3209.45	12.21	18.96	-28.5	104.0	--	--

Figure 14-1. Histogram of A/R for GRAPE - WINE-YOUNG fields in the Coalition.



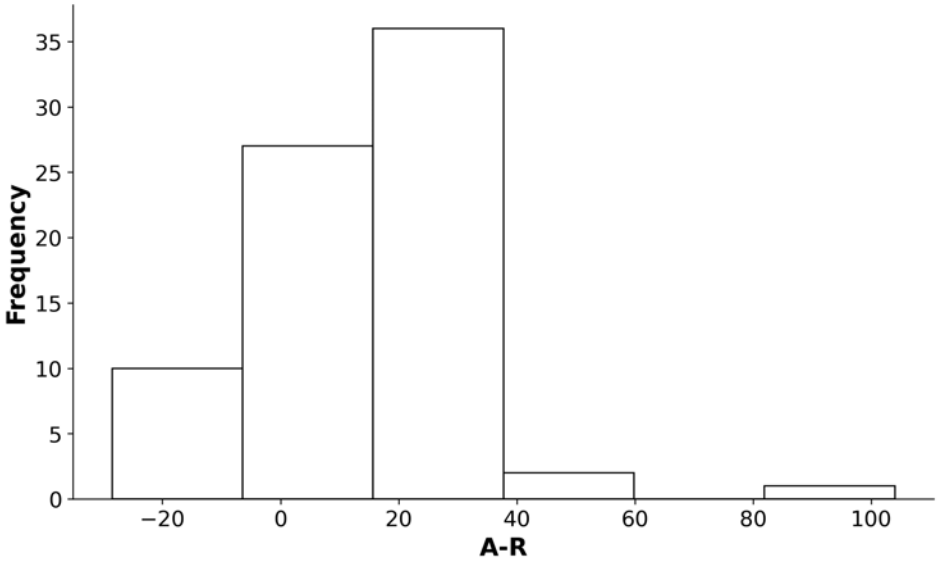
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 14-2. Box and whisker plot of A/R for GRAPE - WINE-YOUNG fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 14-3. Histogram of A-R for GRAPE - WINE-YOUNG fields in the Coalition.



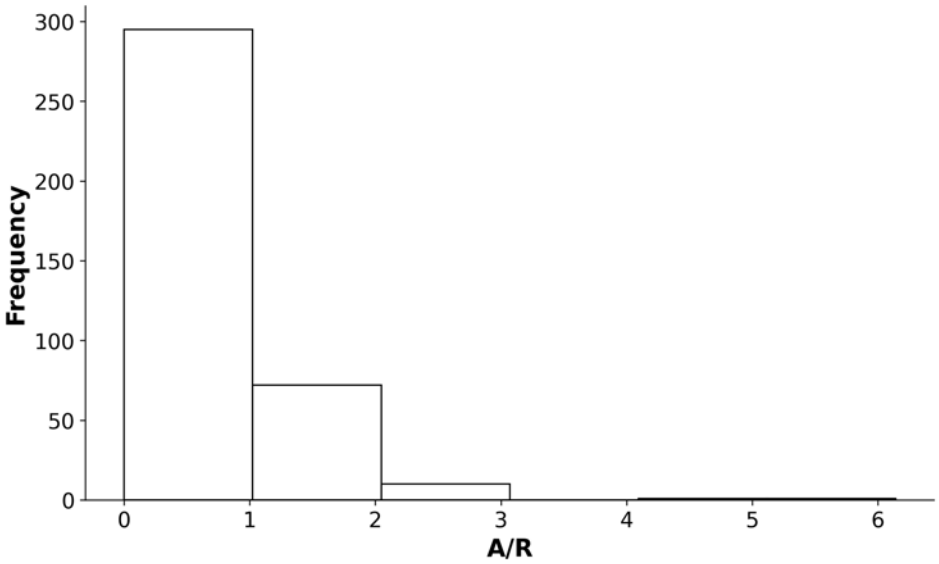
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

15. HAY/FORAGE

Table 15-1. Summary statistics for HAY/FORAGE fields in Coalition.

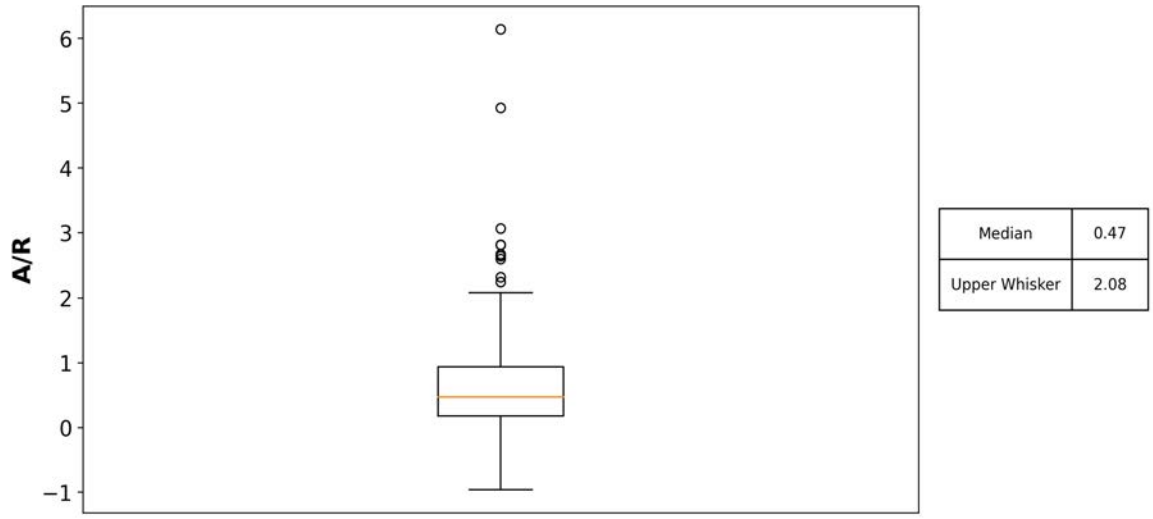
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	378	18285.46	0.66	0.71	0.0	6.14	--	--
A-R	378	18285.46	-107.05	176.15	-1185.0	199.27	--	--
Multi-year A/R	17	677.06	0.2	0.23	0.0	0.74	--	--
Multi-year A-R	17	677.06	-508.92	240.29	-982.65	-192.25	--	--

Figure 15-1. Histogram of A/R for HAY/FORAGE fields in the Coalition.



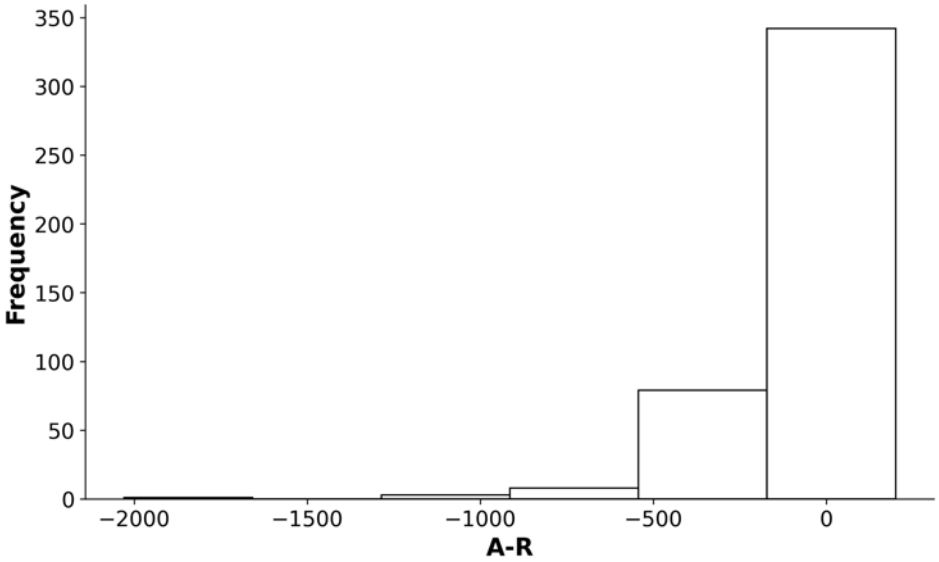
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 15-2. Box and whisker plot of A/R for HAY/FORAGE fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 15-3. Histogram of A-R for HAY/FORAGE fields in the Coalition.



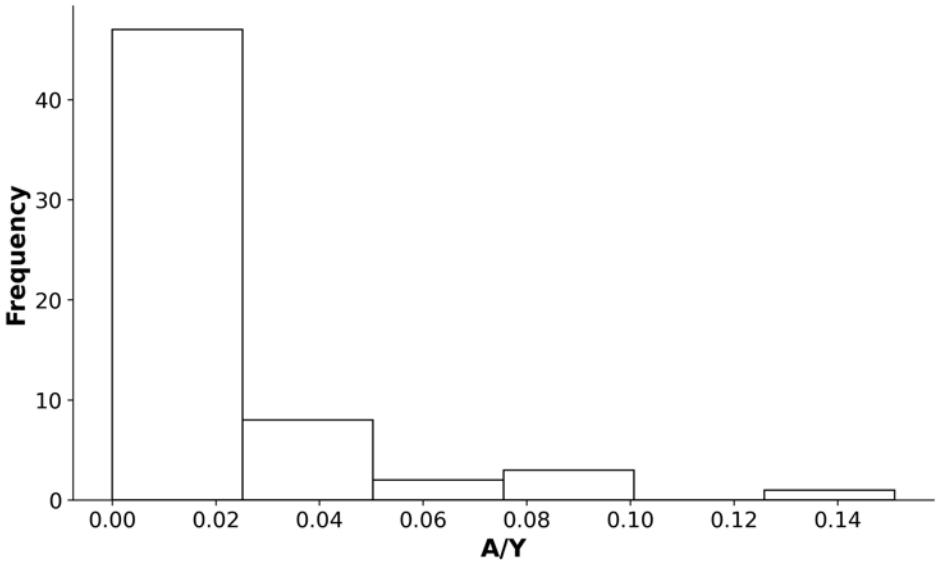
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

16. KIWI

Table 16-1. Summary statistics for KIWI fields in Coalition.

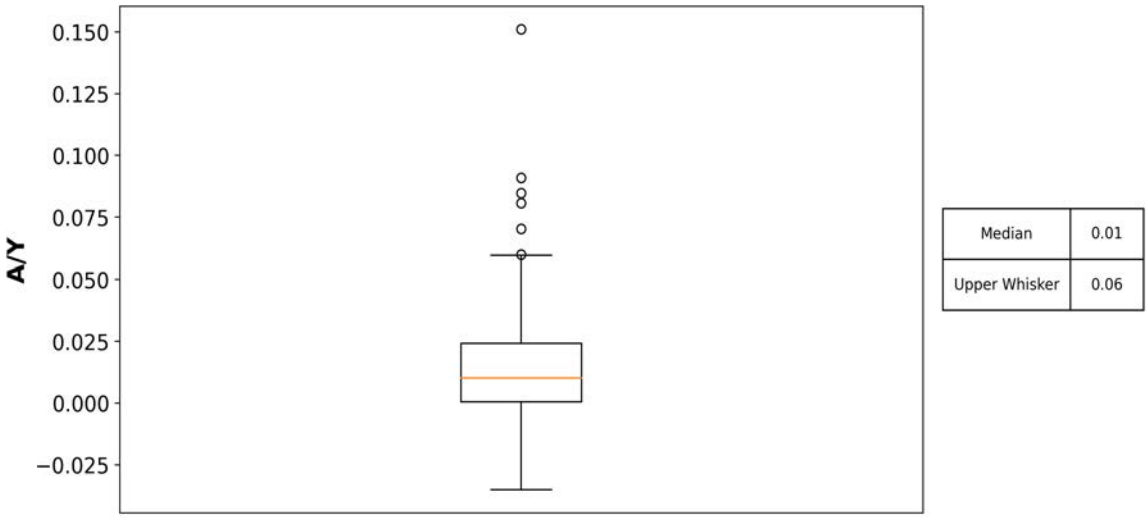
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	62	1032.85	0.03	0.08	0.0	0.59	--	--

Figure 16-1. Histogram of A/Y for KIWI fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 16-2. Box and whisker plot of A/Y for KIWI fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

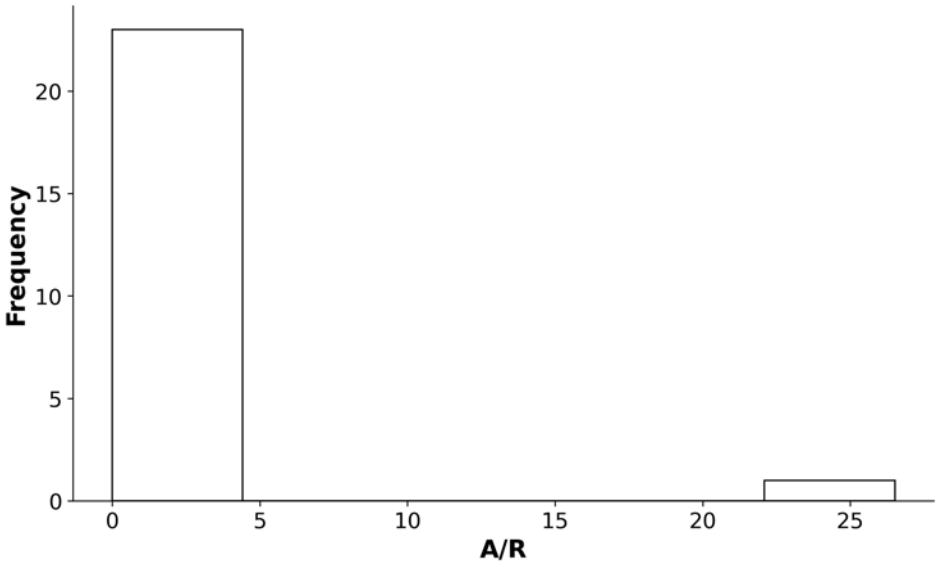
17. MELON

Table 17-1. Summary statistics for MELON fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	24	1322.48	3.88	4.99	0.0	26.51	11.66	0
A-R	24	1322.48	72.48	41.52	-17.19	131.83	--	--

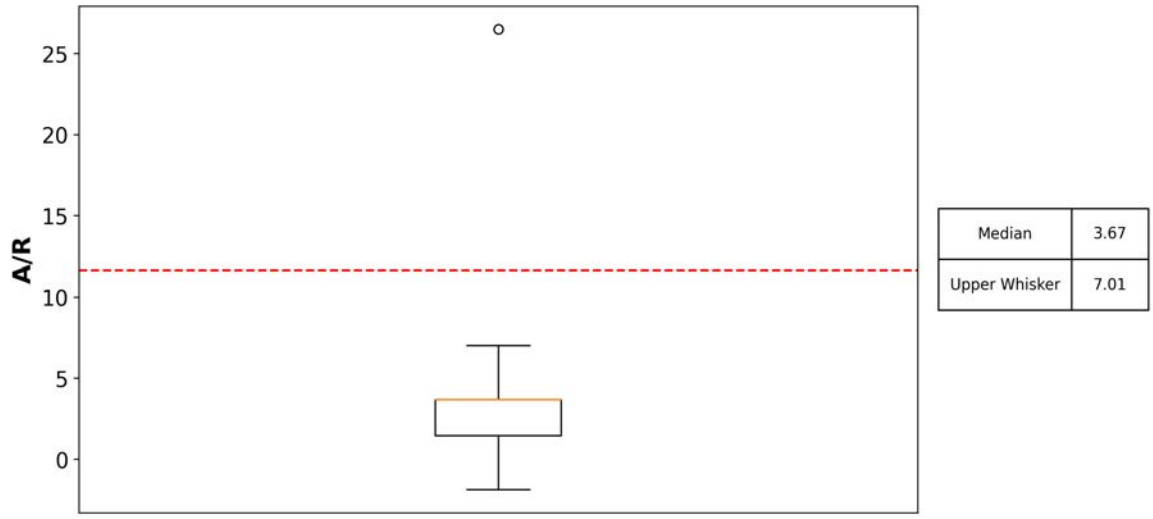
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 17-1. Histogram of A/R for MELON fields in the Coalition.



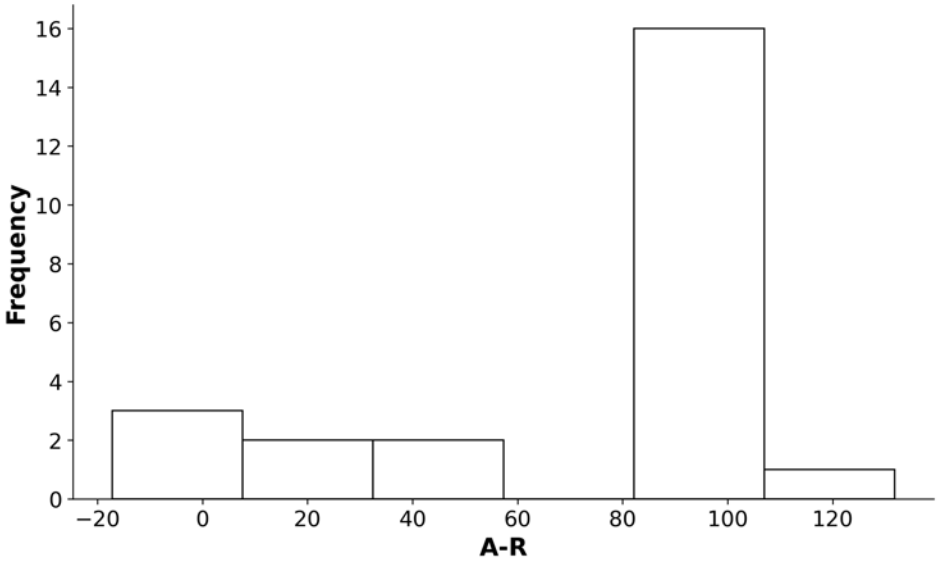
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 17-2. Box and whisker plot of A/R for MELON fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 17-3. Histogram of A-R for MELON fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

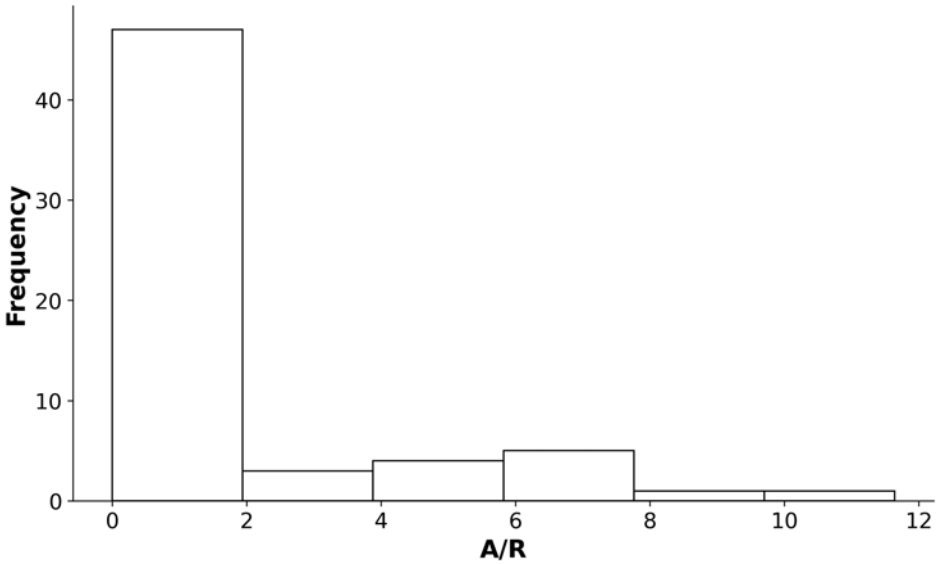
18. OAT - HAY

Table 18-1. Summary statistics for OAT - HAY fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	61	2182.36	1.85	2.38	0.0	11.64	9.55	0
A-R	61	2182.36	13.83	60.82	-130.2	178.3	--	--

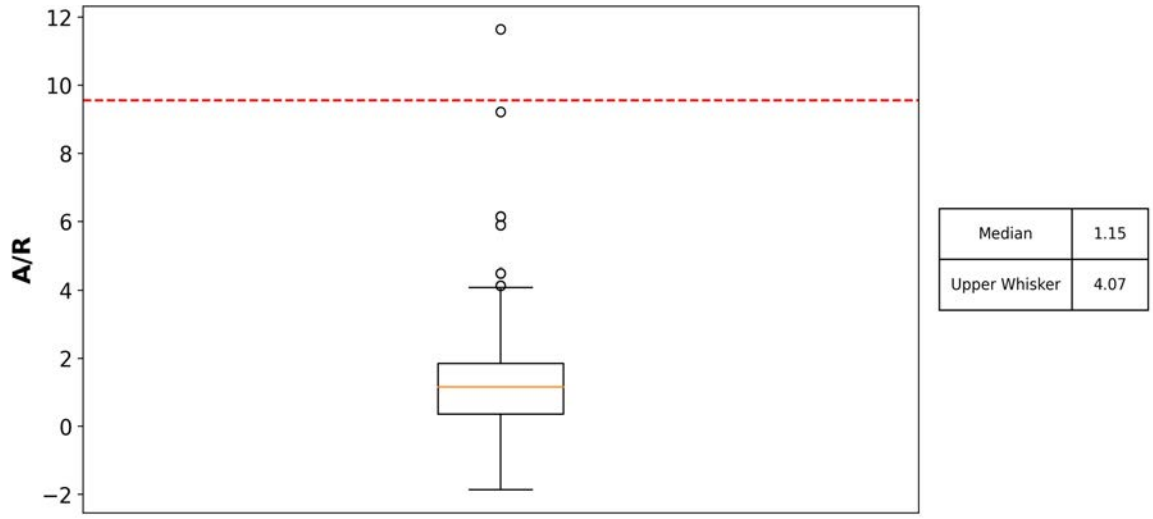
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 18-1. Histogram of A/R for OAT - HAY fields in the Coalition.



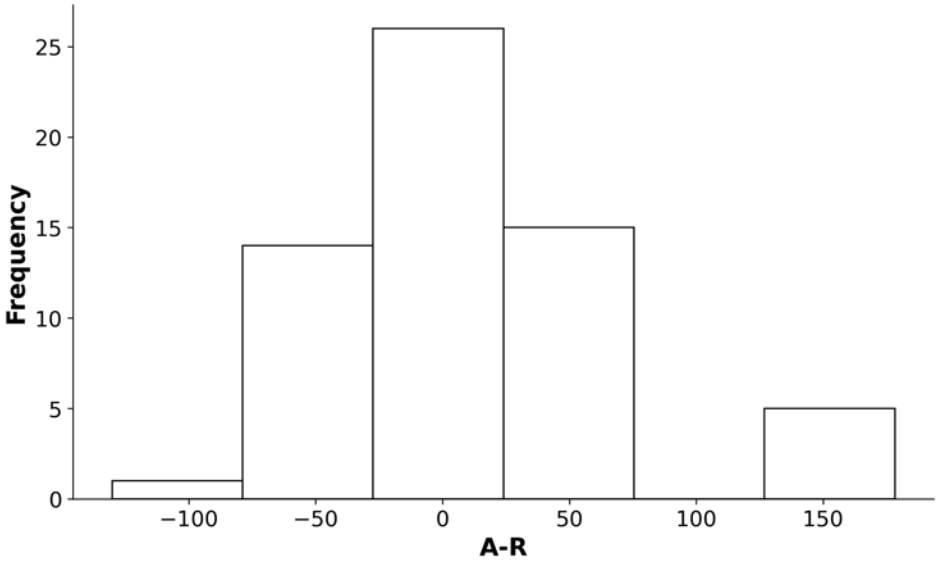
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 18-2. Box and whisker plot of A/R for OAT - HAY fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 18-3. Histogram of A-R for OAT - HAY fields in the Coalition.



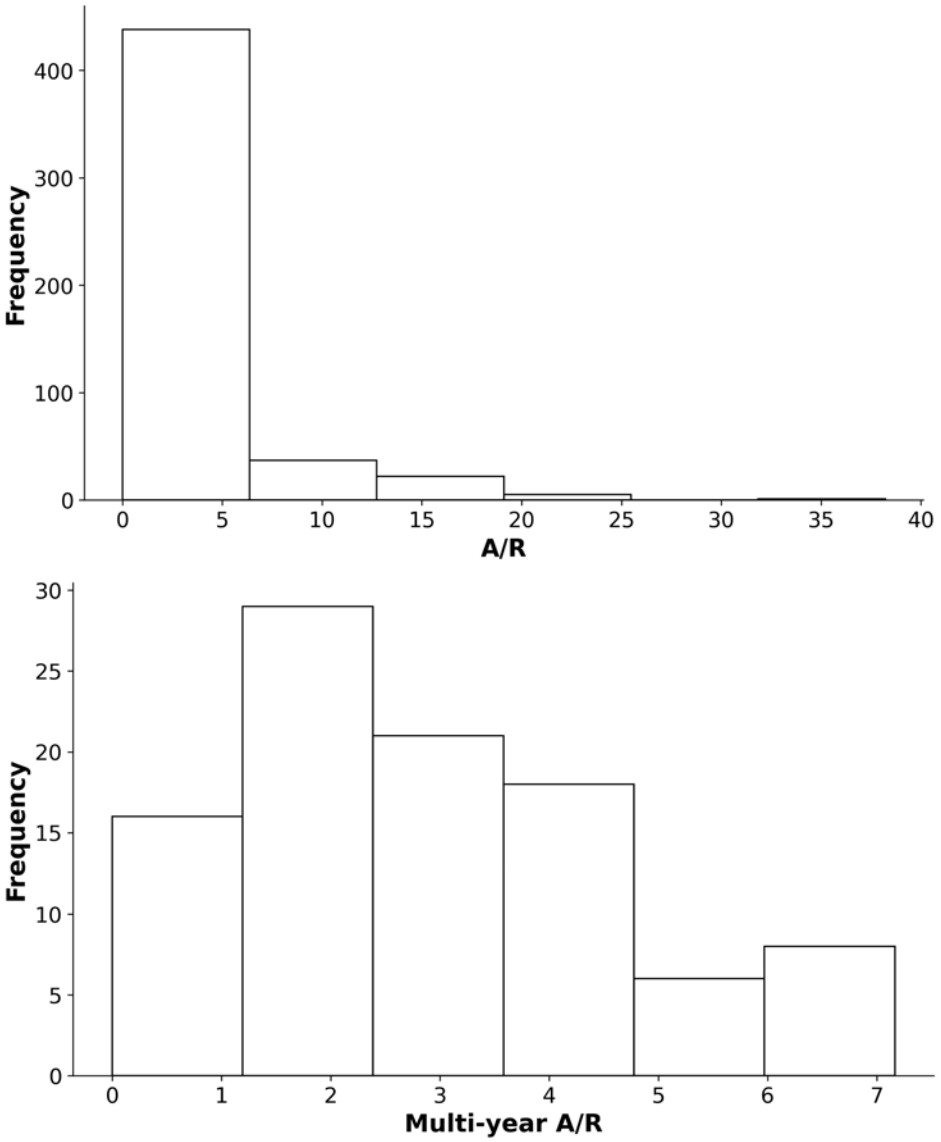
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

19. OLIVE

Table 19-1. Summary statistics for OLIVE fields in Coalition.

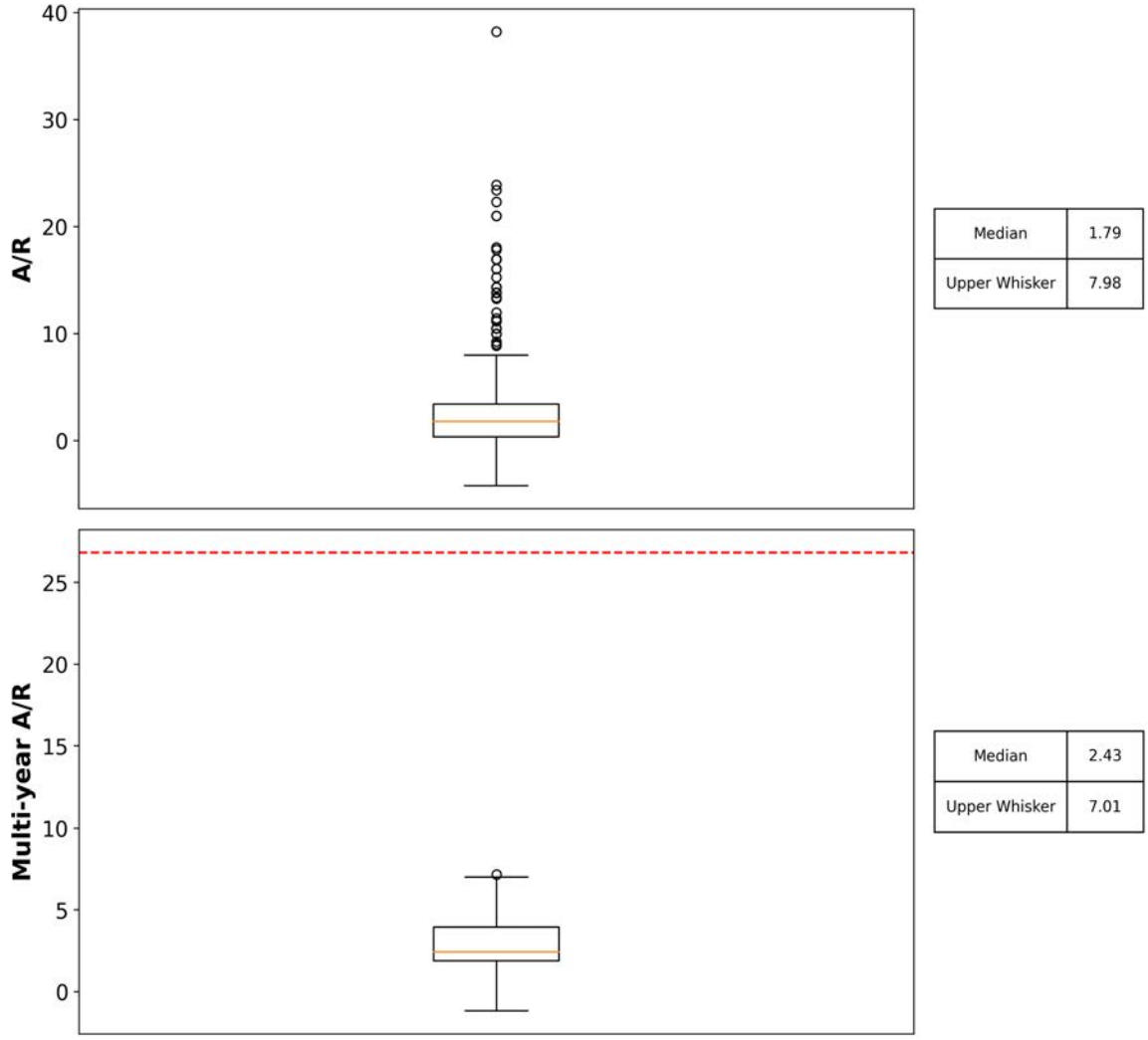
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	505	18846.63	3.74	6.87	0.0	64.01	--	--
A-R	505	18846.63	34.92	53.21	-100.48	269.86	--	--
Multi-year A/R	98	4758.78	2.84	1.7	0.0	7.17	26.82	0
Multi-year A-R	98	4758.78	140.26	130.57	-63.74	503.36	--	--

Figure 19-1. Histogram of A/R for OLIVE fields in the Coalition.



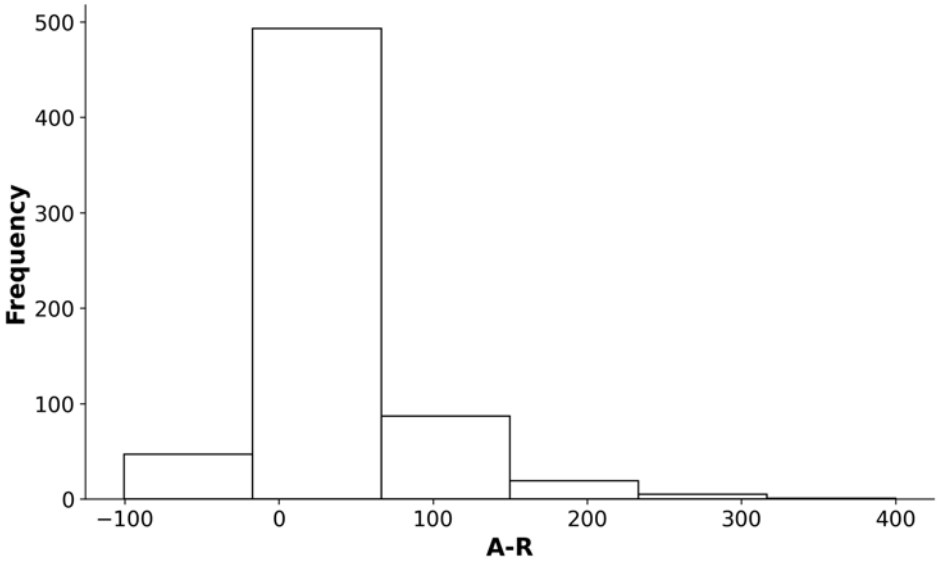
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 19-2. Box and whisker plot of A/R for OLIVE fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 19-3. Histogram of A-R for OLIVE fields in the Coalition.



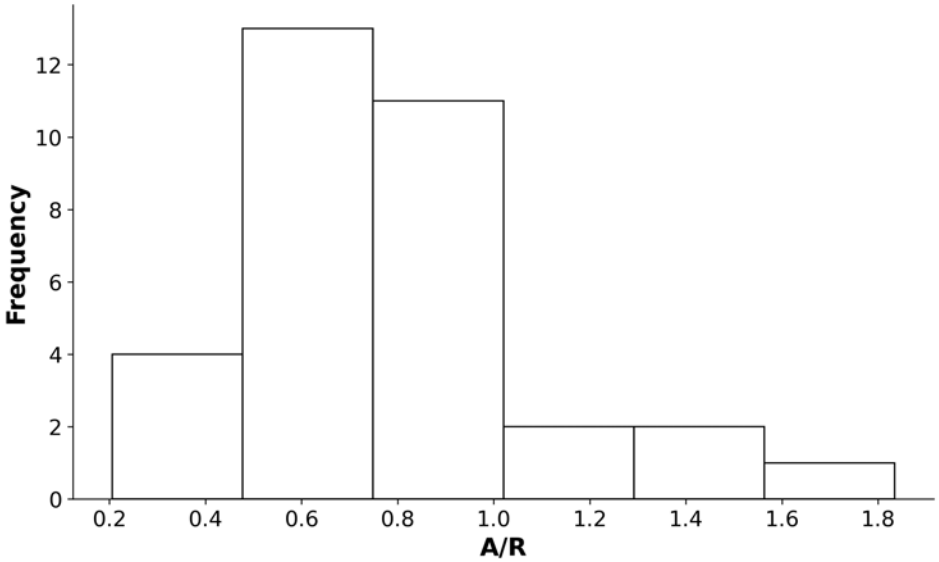
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

20. ORCHARD GRASS - HAY

Table 20-1. Summary statistics for ORCHARD GRASS - HAY fields in Coalition.

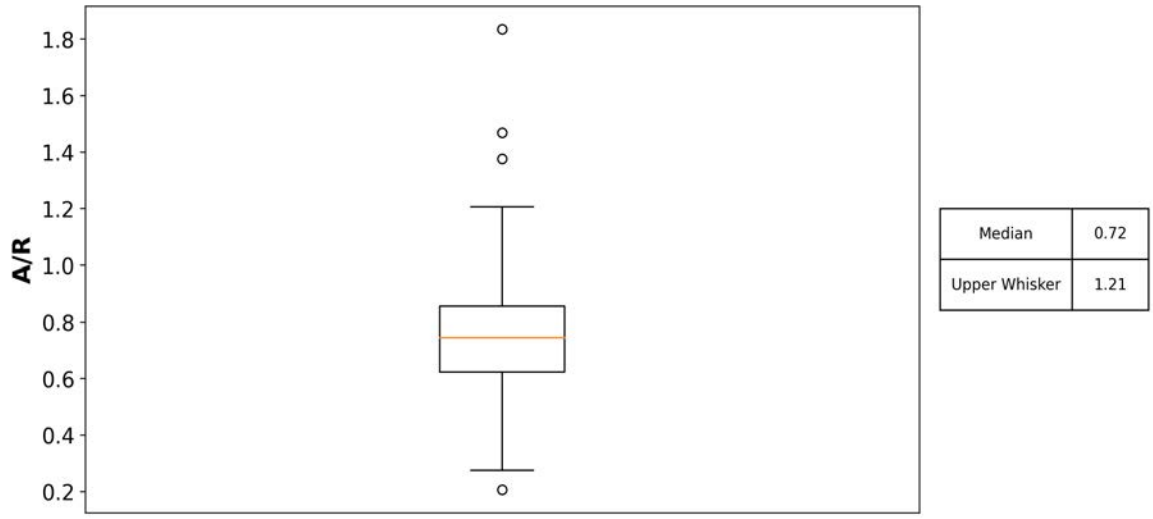
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	34	2307.76	1.04	1.58	0.21	9.78	--	--
A-R	34	2307.76	-56.11	77.16	-181.5	136.5	--	--

Figure 20-1. Histogram of A/R for ORCHARD GRASS - HAY fields in the Coalition.



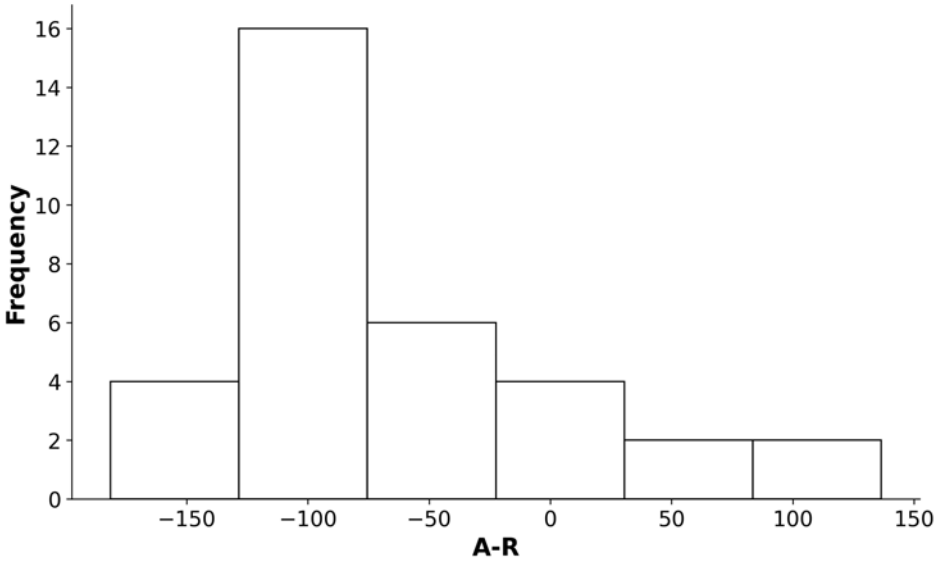
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 20-2. Box and whisker plot of A/R for ORCHARD GRASS - HAY fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 20-3. Histogram of A-R for ORCHARD GRASS - HAY fields in the Coalition.



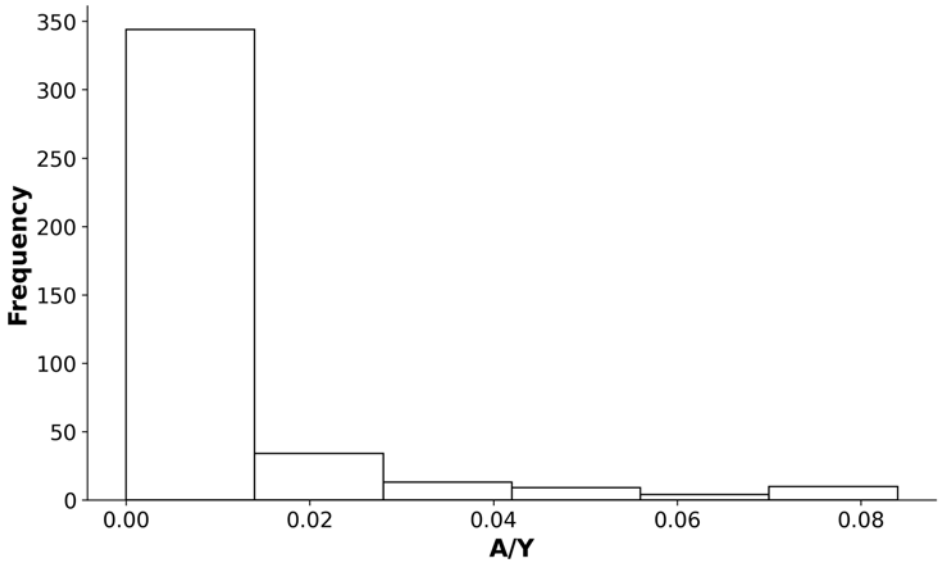
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

21. PASTURE

Table 21-1. Summary statistics for PASTURE fields in Coalition.

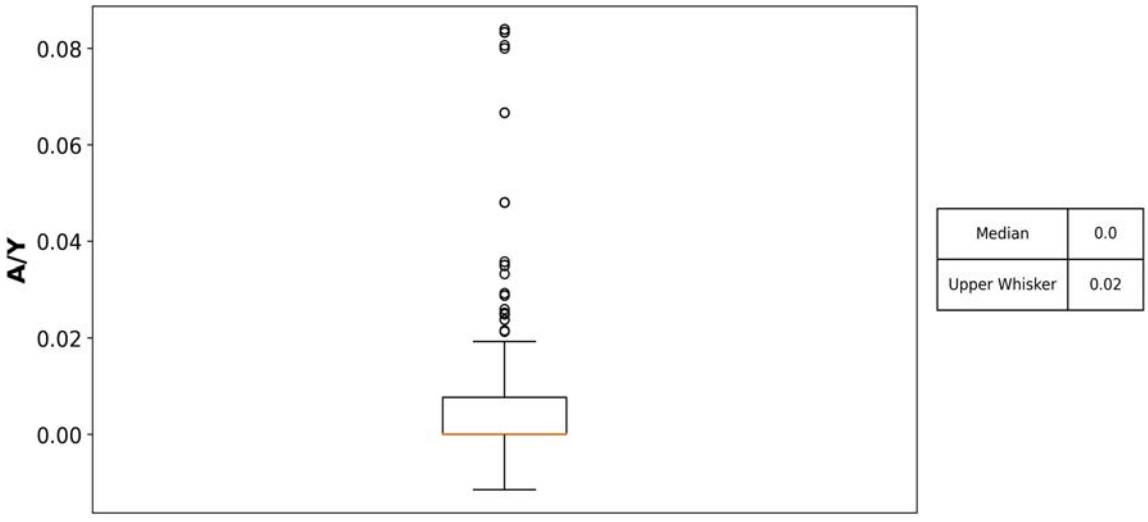
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	175	13209.96	0.06	0.57	0.0	7.5	--	--

Figure 21-1. Histogram of A/Y for PASTURE fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 21-2. Box and whisker plot of A/Y for PASTURE fields in the Coalition.



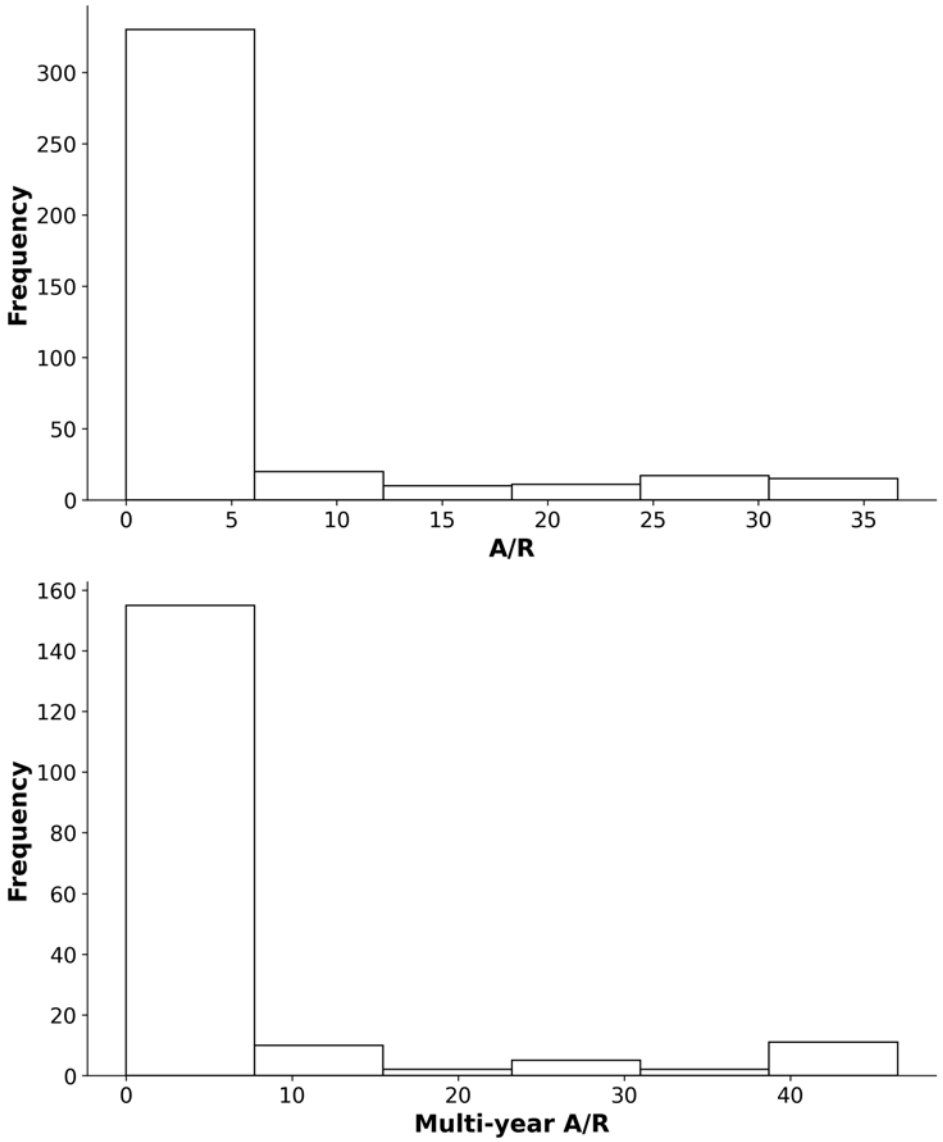
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

22. PEACH/NECTARINE

Table 22-1. Summary statistics for PEACH/NECTARINE fields in Coalition.

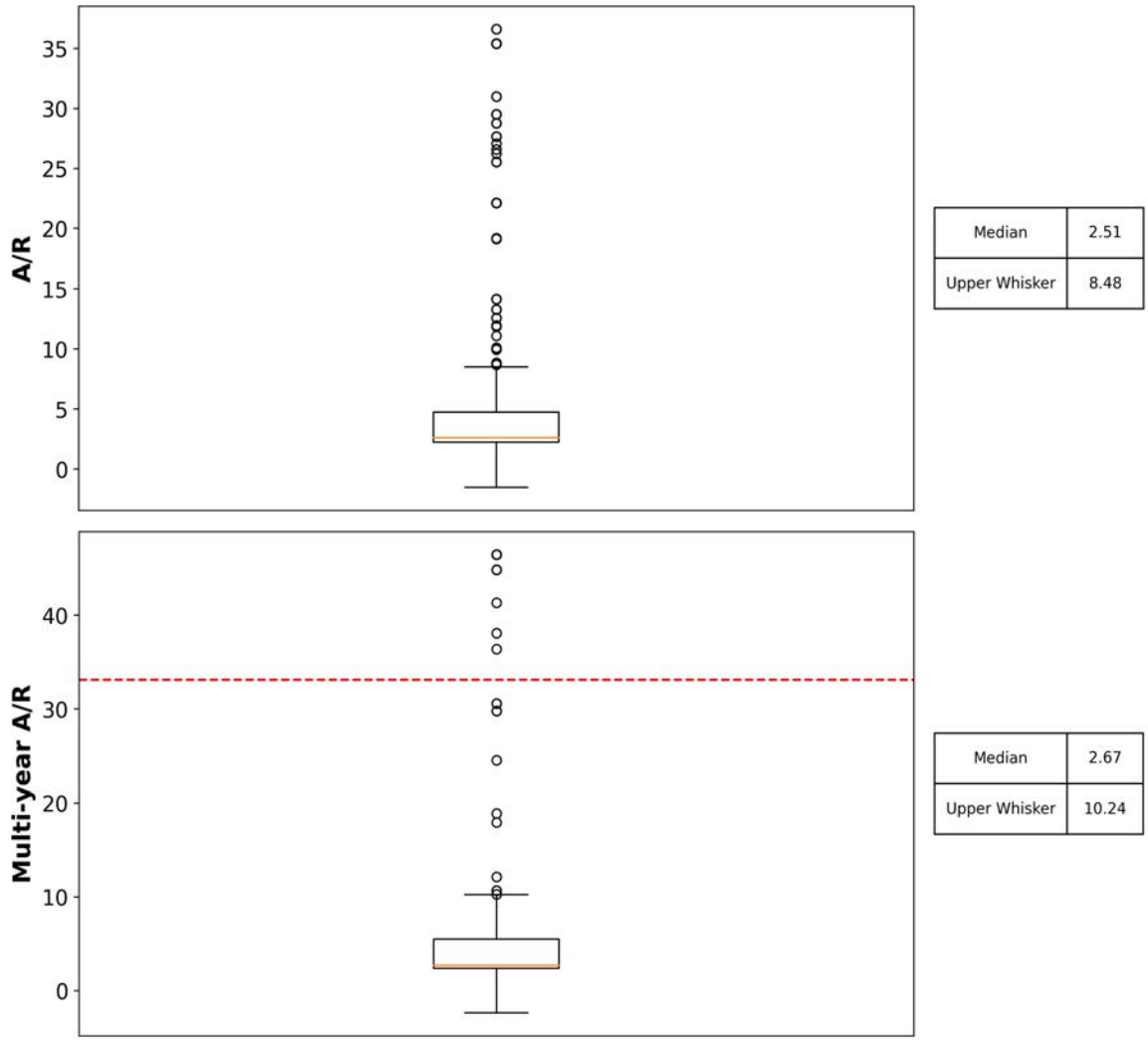
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	414	9200.05	7.53	12.31	0.0	65.04	--	--
A-R	414	9200.05	69.31	49.96	-45.2	294.88	--	--
Multi-year A/R	185	4713.53	7.24	11.35	0.0	46.46	33.08	13
Multi-year A-R	185	4713.53	249.2	151.91	-41.42	781.89	--	--

Figure 22-1. Histogram of A/R for PEACH/NECTARINE fields in the Coalition.



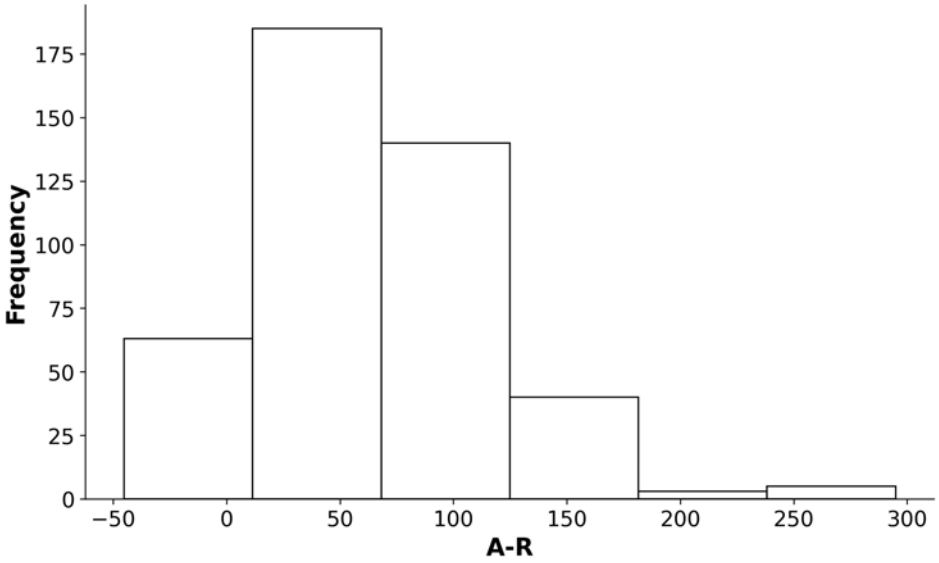
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 22-2. Box and whisker plot of A/R for PEACH/NECTARINE fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 22-3. Histogram of A-R for PEACH/NECTARINE fields in the Coalition.



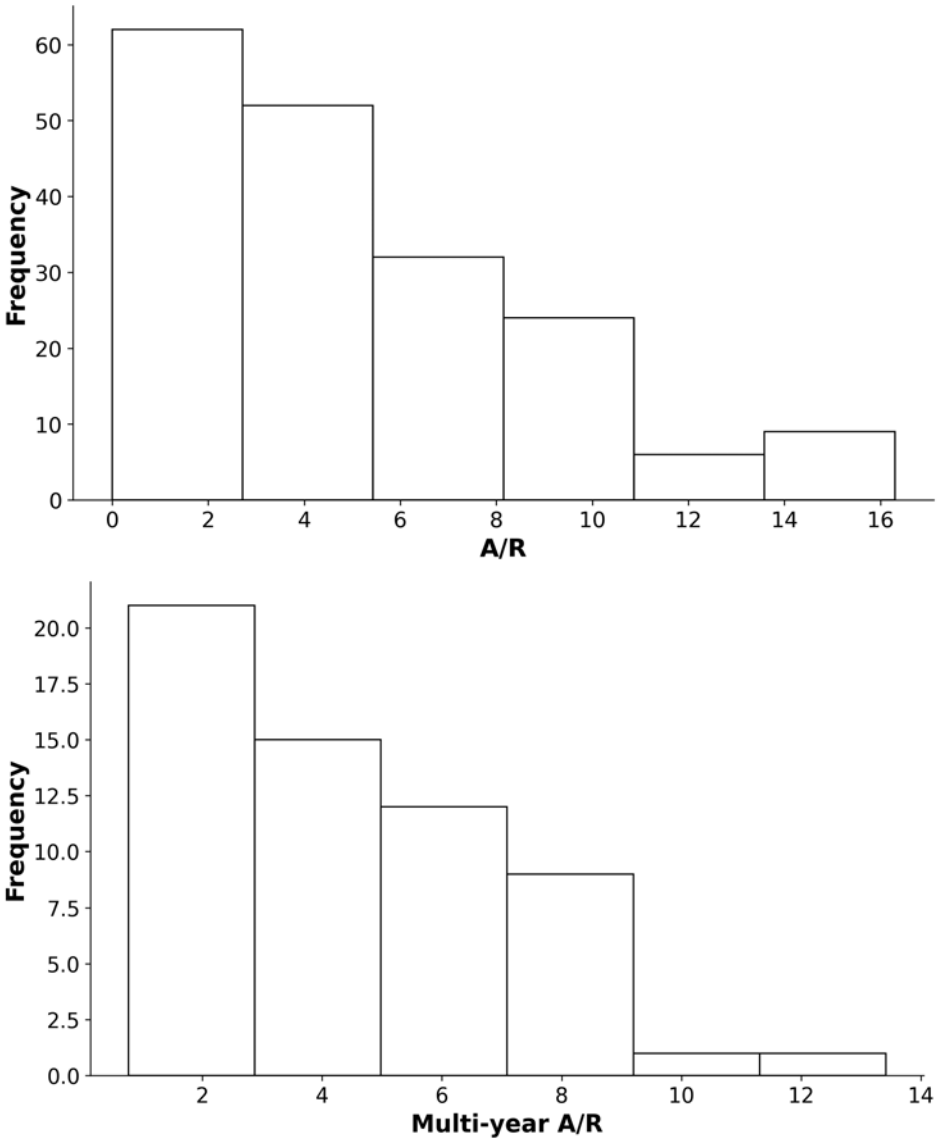
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

23. PEAR

Table 23-1. Summary statistics for PEAR fields in Coalition.

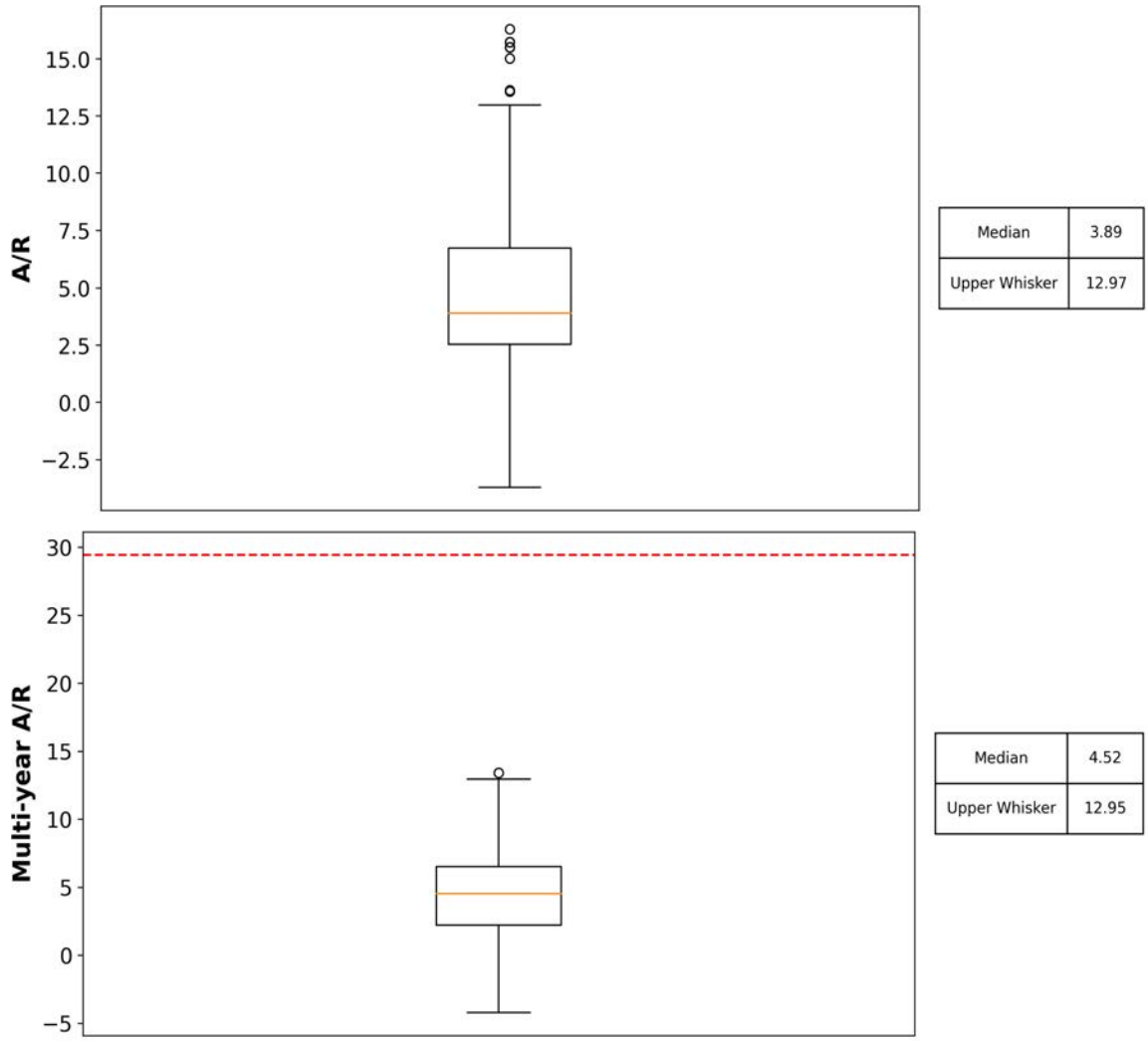
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	185	5746.62	5.05	3.95	0.0	16.3	--	--
A-R	185	5746.62	76.36	66.34	-34.83	226.32	--	--
Multi-year A/R	59	2640.8	4.58	2.69	0.76	13.41	29.45	0
Multi-year A-R	59	2640.8	187.14	124.55	-14.92	416.24	--	--

Figure 23-1. Histogram of A/R for PEAR fields in the Coalition.



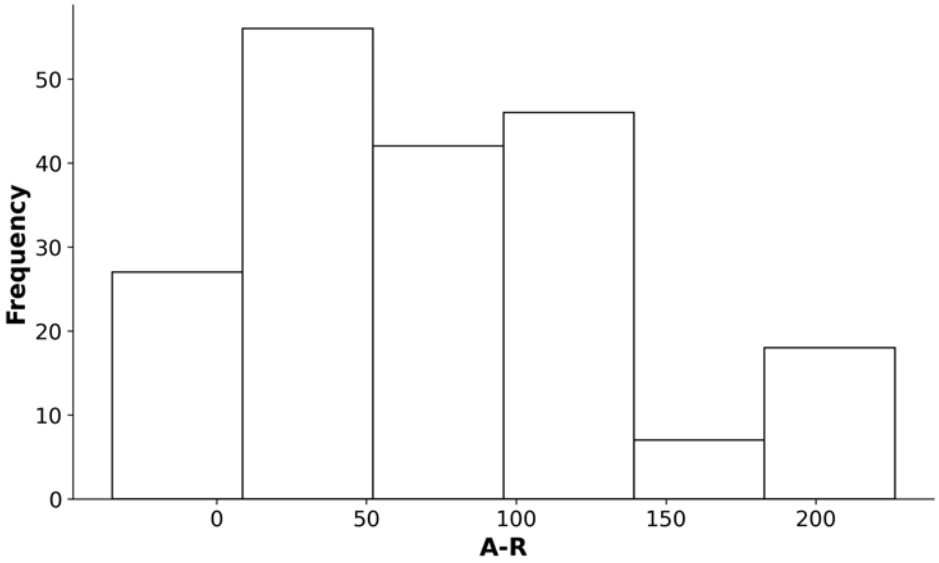
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 23-2. Box and whisker plot of A/R for PEAR fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 23-3. Histogram of A-R for PEAR fields in the Coalition.



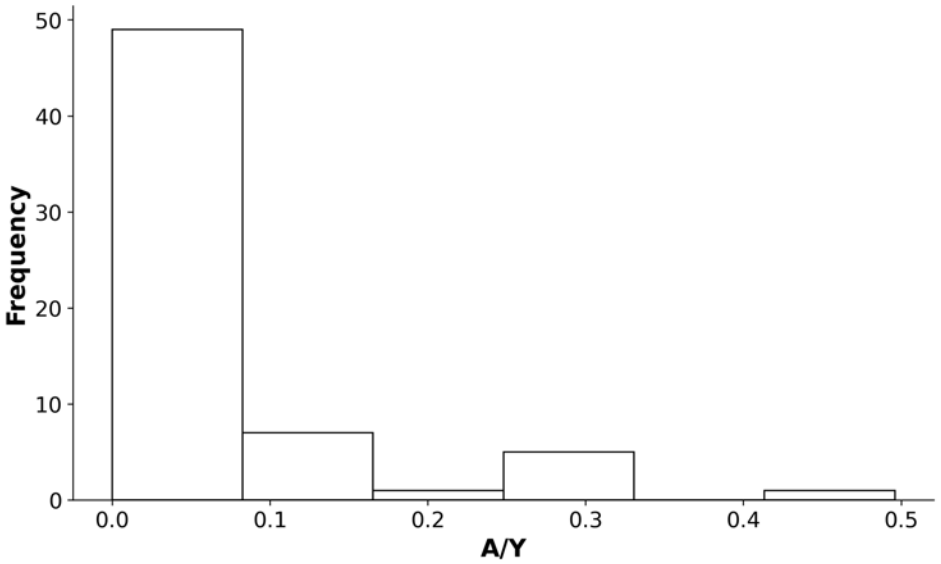
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

24. PECAN

Table 24-1. Summary statistics for PECAN fields in Coalition.

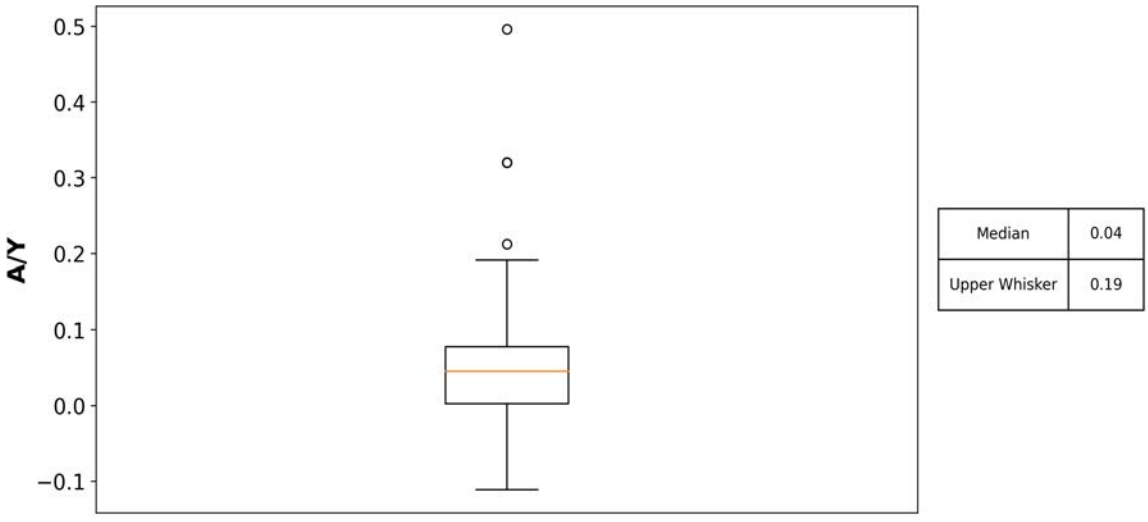
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	63	1538.66	0.07	0.1	0.0	0.5	--	--

Figure 24-1. Histogram of A/Y for PECAN fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 24-2. Box and whisker plot of A/Y for PECAN fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

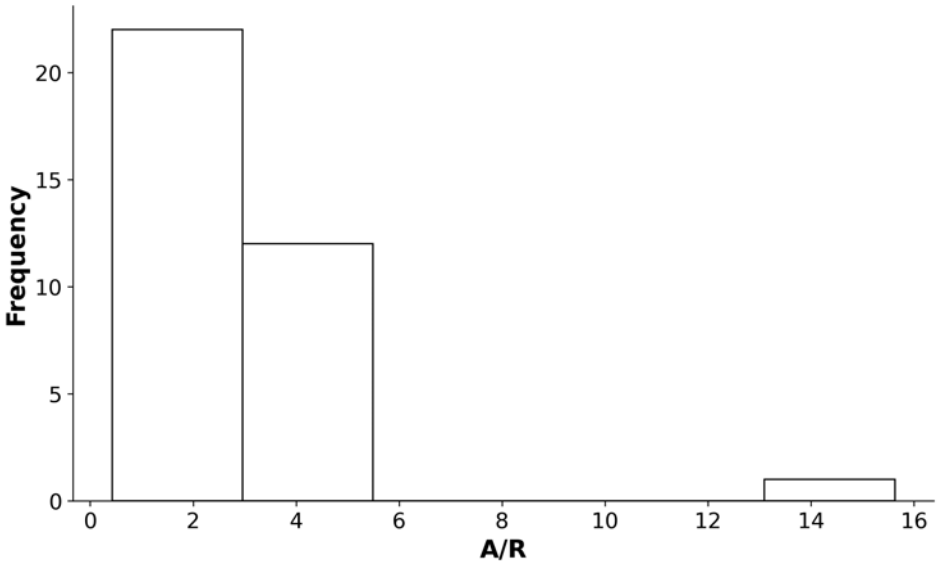
25. PEPPER

Table 25-1. Summary statistics for PEPPER fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	35	1216.66	3.02	2.39	0.43	15.63	10.9	1
A-R	35	1216.66	120.07	52.79	-5.68	280.8	--	--

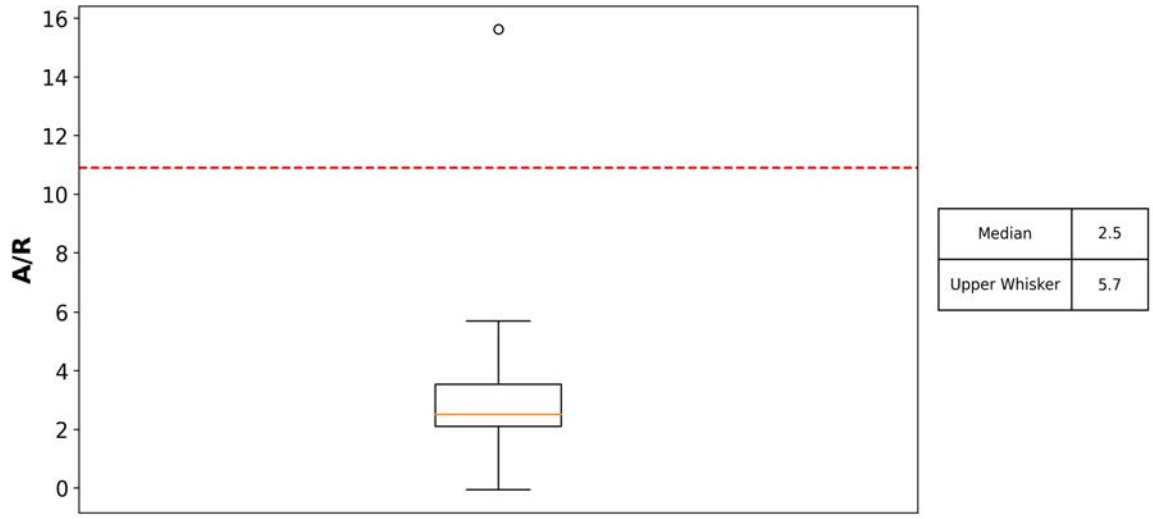
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 25-1. Histogram of A/R for PEPPER fields in the Coalition.



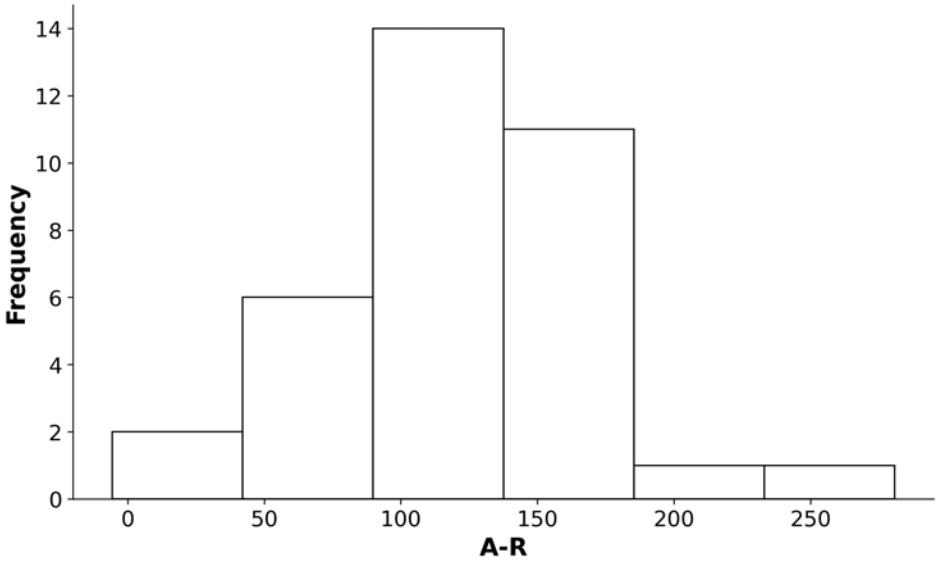
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 25-2. Box and whisker plot of A/R for PEPPER fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 25-3. Histogram of A-R for PEPPER fields in the Coalition.



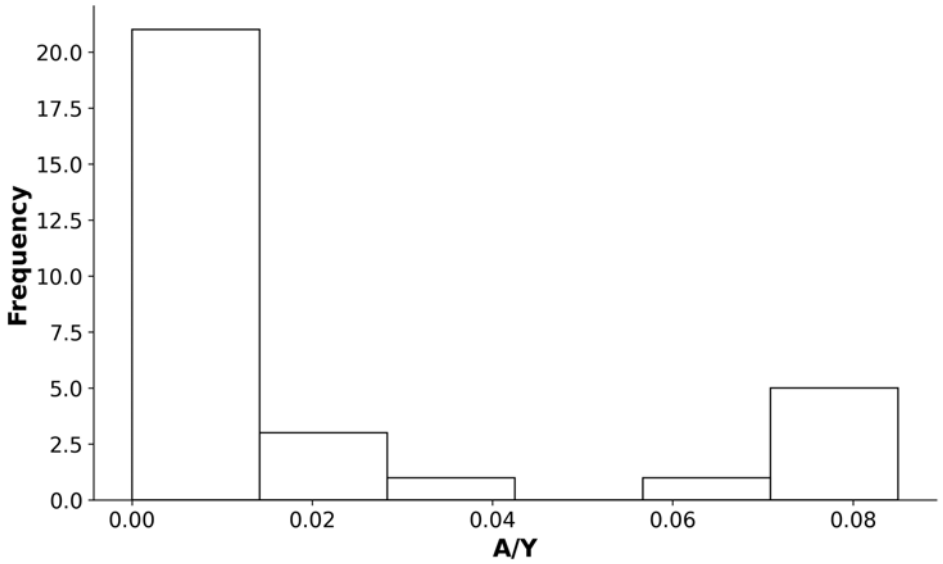
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

26. PERSIMMON

Table 26-1. Summary statistics for PERSIMMON fields in Coalition.

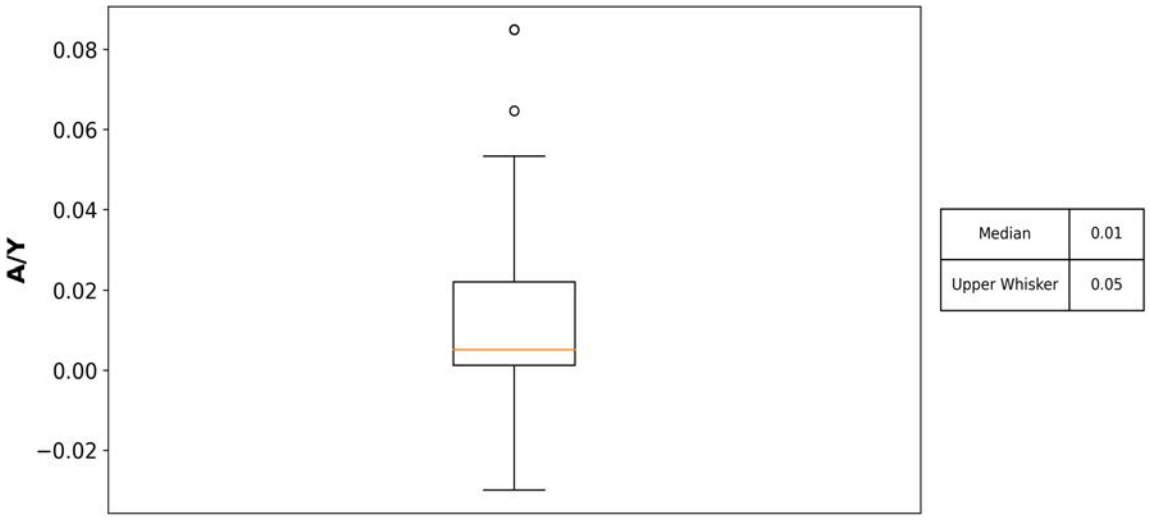
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	31	344.28	0.02	0.03	0.0	0.08	--	--

Figure 26-1. Histogram of A/Y for PERSIMMON fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 26-2. Box and whisker plot of A/Y for PERSIMMON fields in the Coalition.



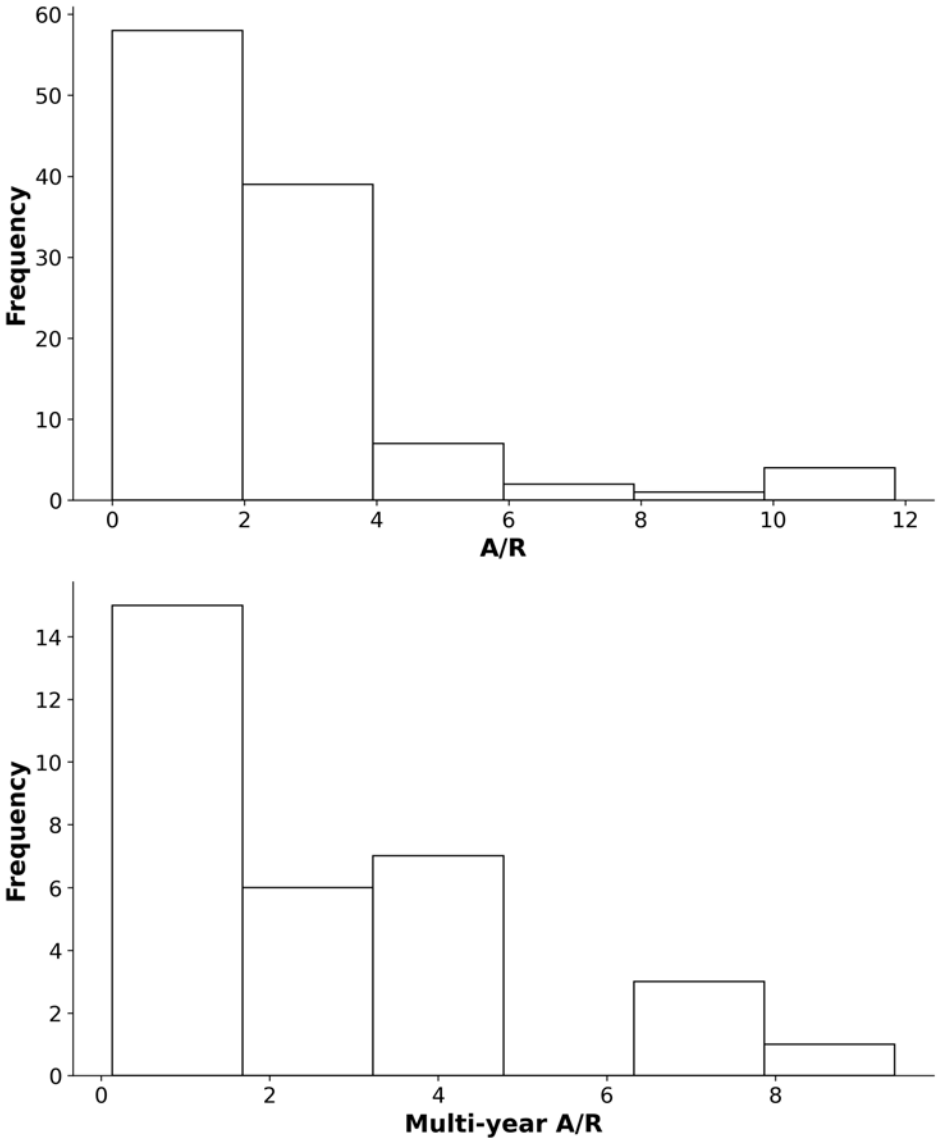
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

27. PISTACHIO

Table 27-1. Summary statistics for PISTACHIO fields in Coalition.

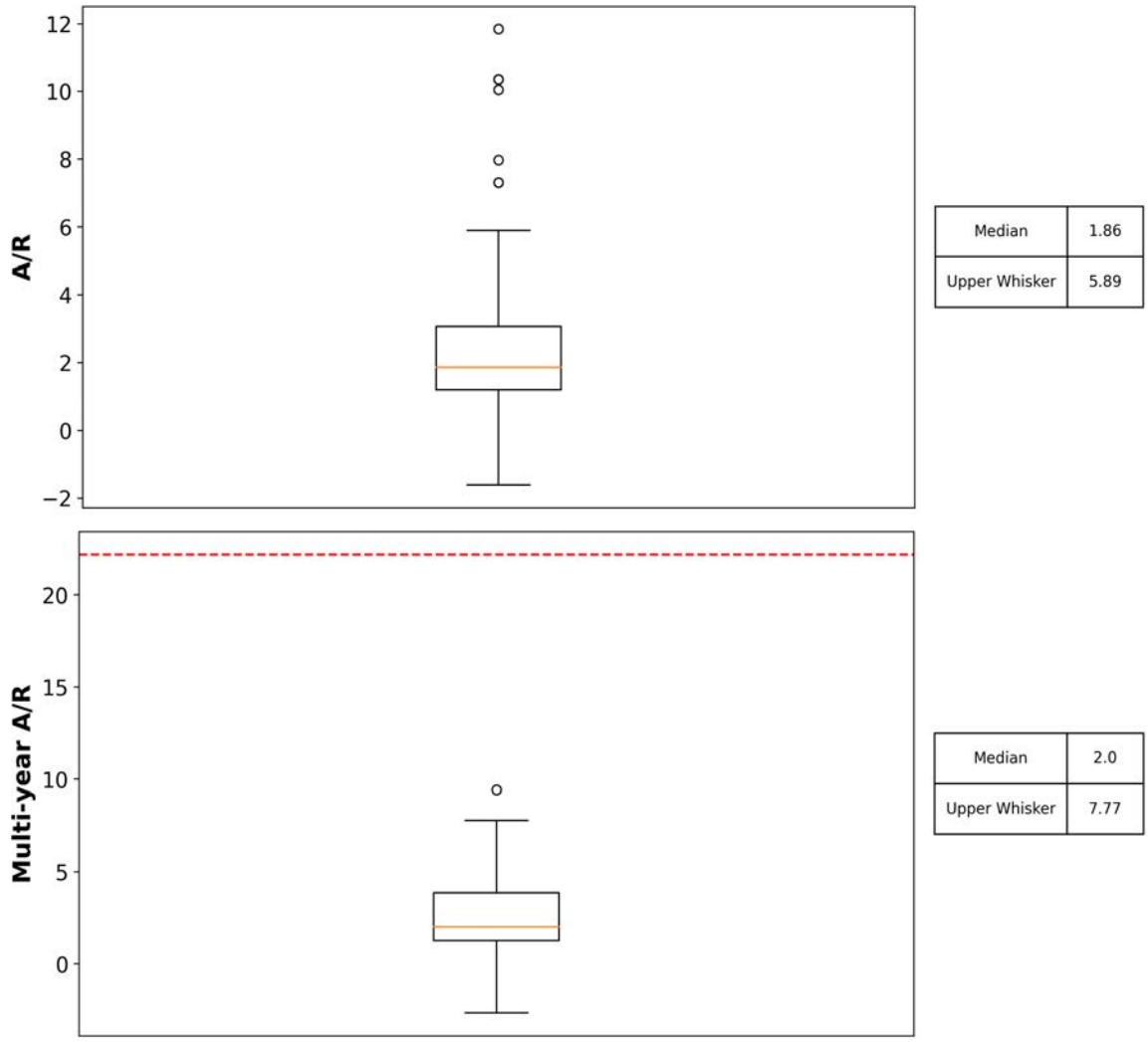
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	111	5909.88	2.49	2.19	0.0	11.84	--	--
A-R	111	5909.88	68.5	80.35	-83.5	305.26	--	--
Multi-year A/R	32	1255.04	2.8	2.19	0.13	9.41	22.18	0
Multi-year A-R	32	1255.04	244.84	271.29	-131.33	925.96	--	--

Figure 27-1. Histogram of A/R for PISTACHIO fields in the Coalition.



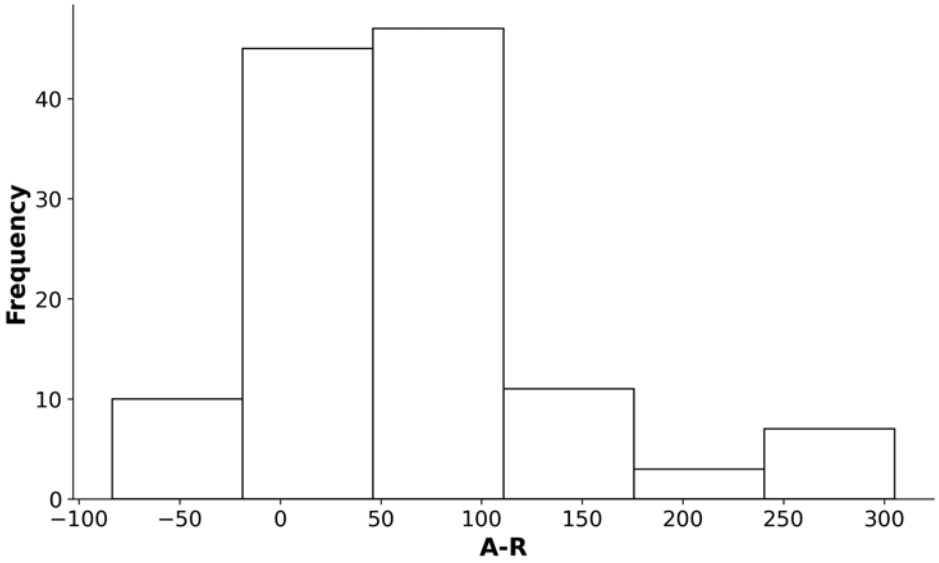
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 27-2. Box and whisker plot of A/R for PISTACHIO fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 27-3. Histogram of A-R for PISTACHIO fields in the Coalition.



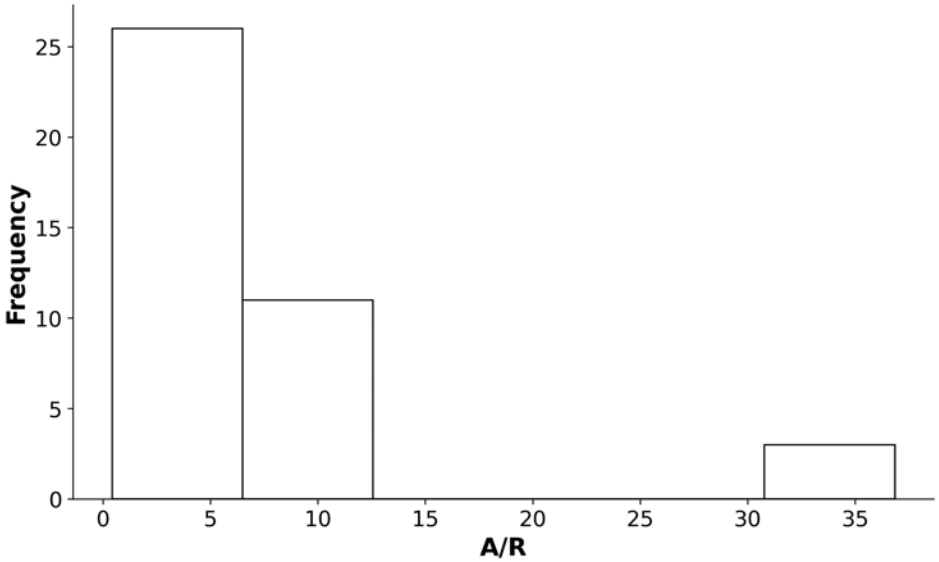
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

28. PISTACHIO-YOUNG

Table 28-1. Summary statistics for PISTACHIO-YOUNG fields in Coalition.

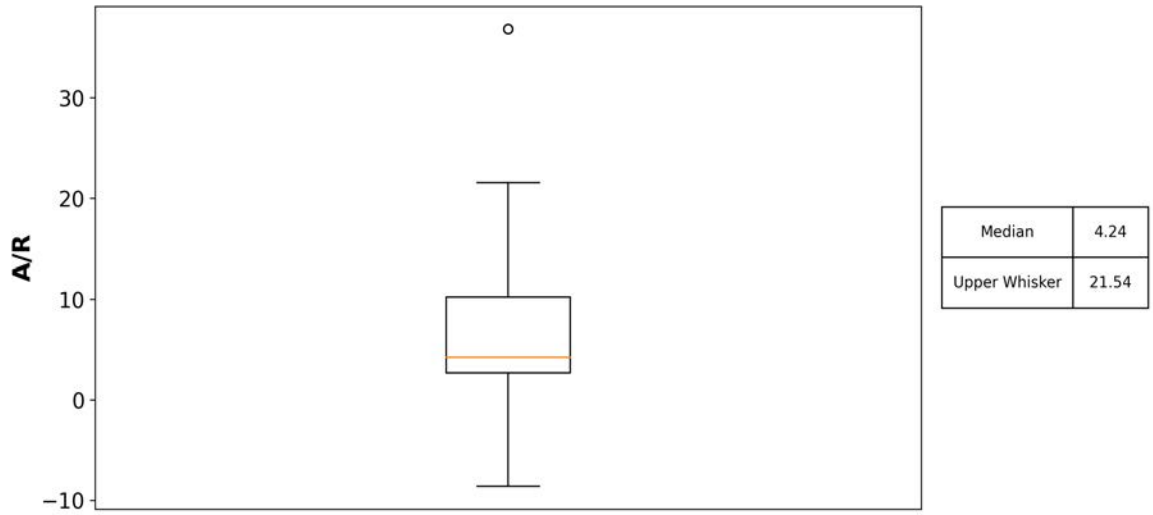
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	40	3877.82	7.96	9.11	0.43	36.85	--	--
A-R	40	3877.82	96.15	73.42	-35.63	269.48	--	--

Figure 28-1. Histogram of A/R for PISTACHIO-YOUNG fields in the Coalition.



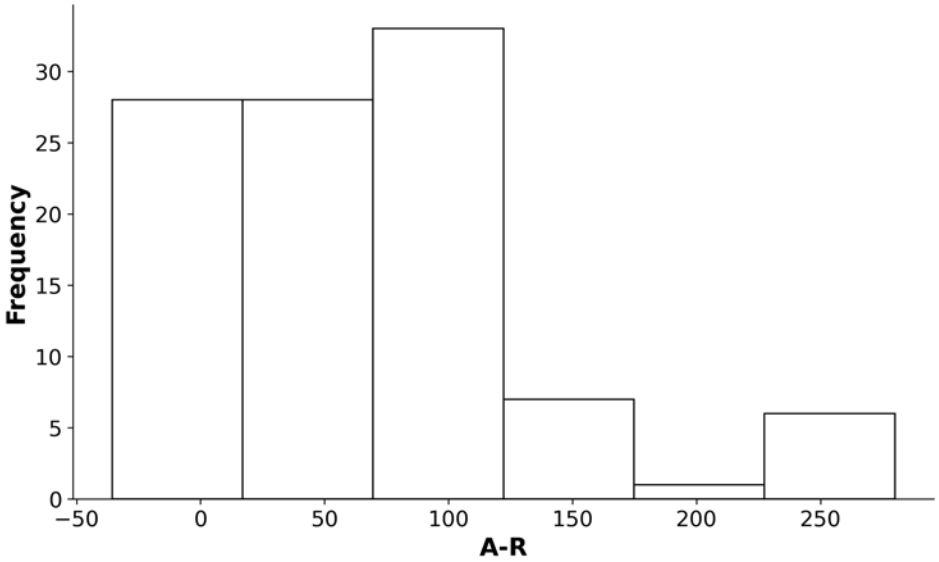
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 28-2. Box and whisker plot of A/R for PISTACHIO-YOUNG fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 28-3. Histogram of A-R for PISTACHIO-YOUNG fields in the Coalition.



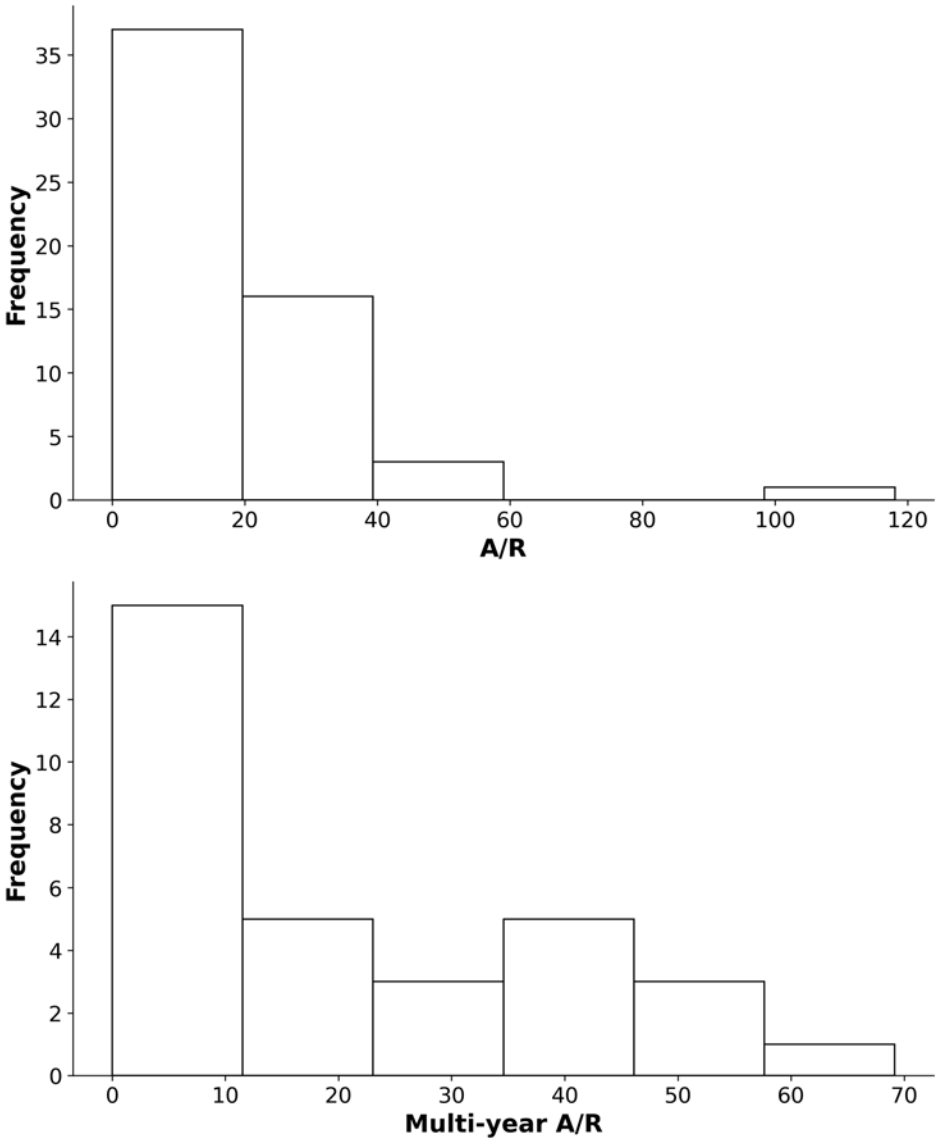
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

29. PLUM/PLUOT

Table 29-1. Summary statistics for PLUM/PLUOT fields in Coalition.

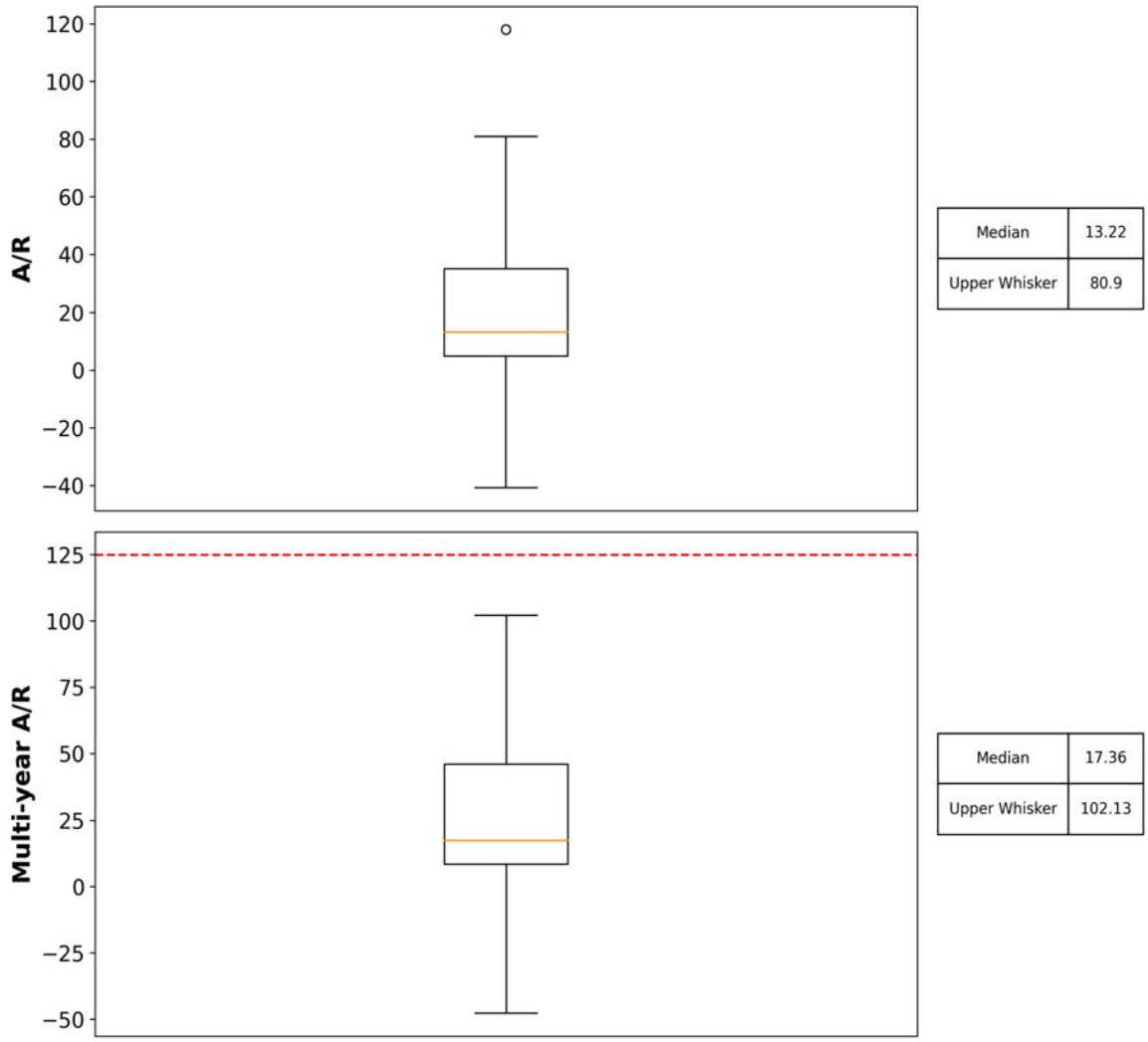
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	56	1819.01	19.03	20.3	0.0	118.06	--	--
A-R	56	1819.01	70.13	39.65	-7.38	130.47	--	--
Multi-year A/R	32	1189.26	22.97	19.15	0.0	69.17	124.93	0
Multi-year A-R	32	1189.26	319.81	198.27	-23.64	593.1	--	--

Figure 29-1. Histogram of A/R for PLUM/PLUOT fields in the Coalition.



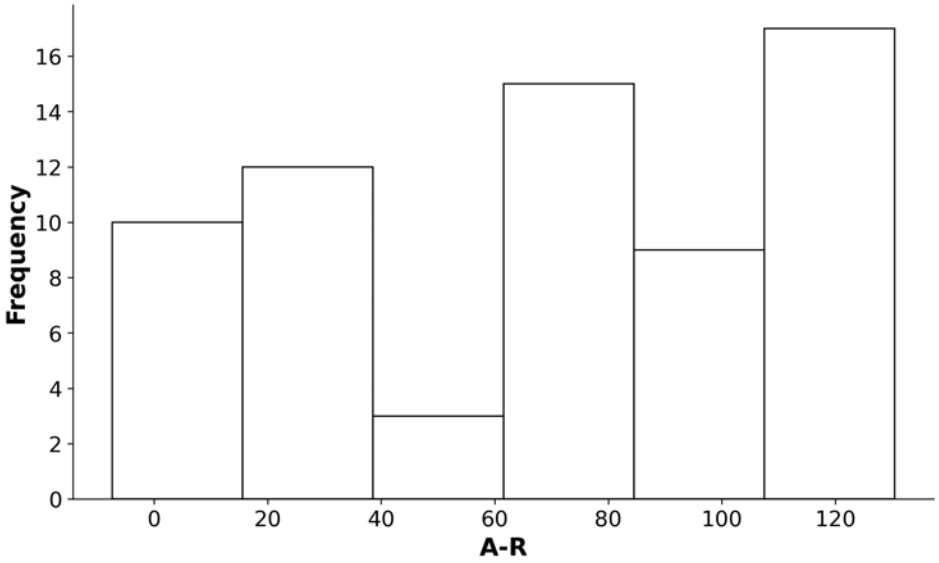
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 29-2. Box and whisker plot of A/R for PLUM/PLUOT fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 29-3. Histogram of A-R for PLUM/PLUOT fields in the Coalition.



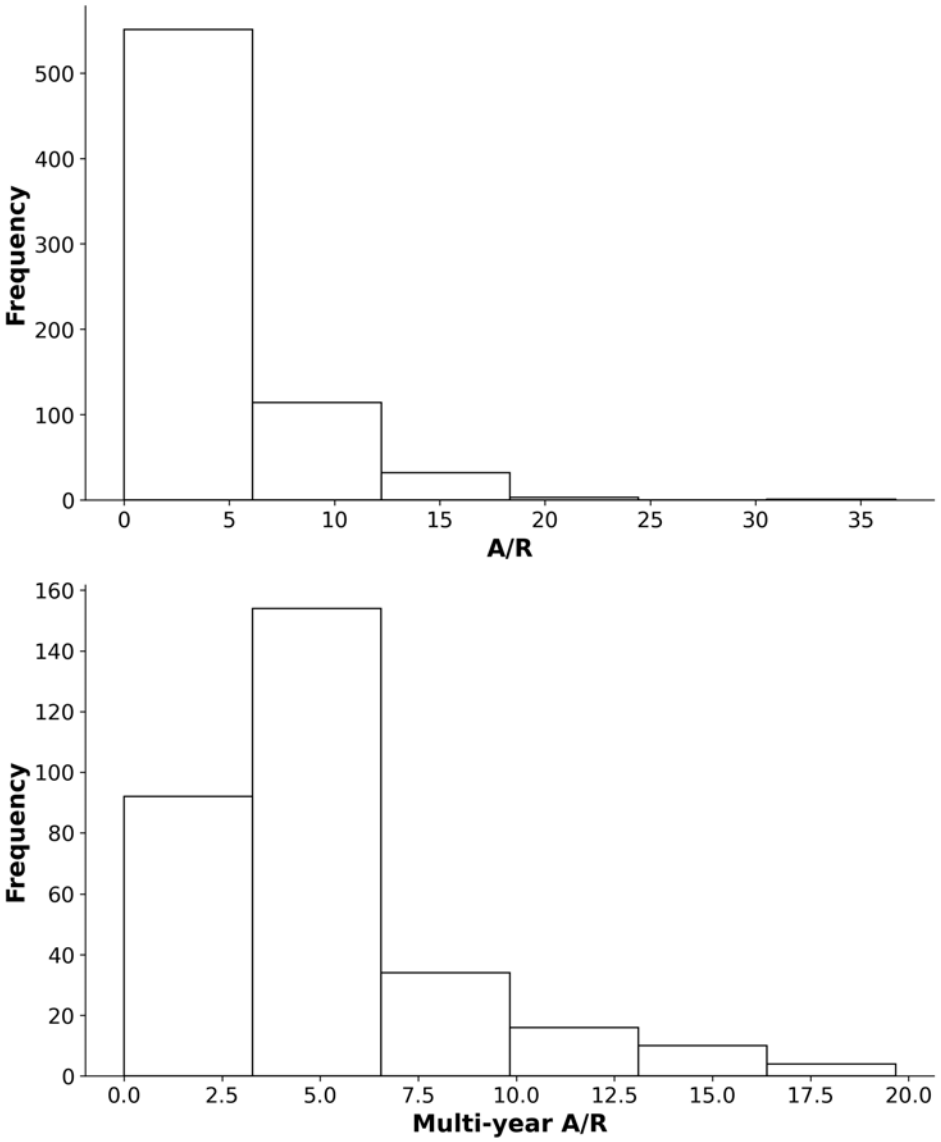
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

30. PRUNE

Table 30-1. Summary statistics for PRUNE fields in Coalition.

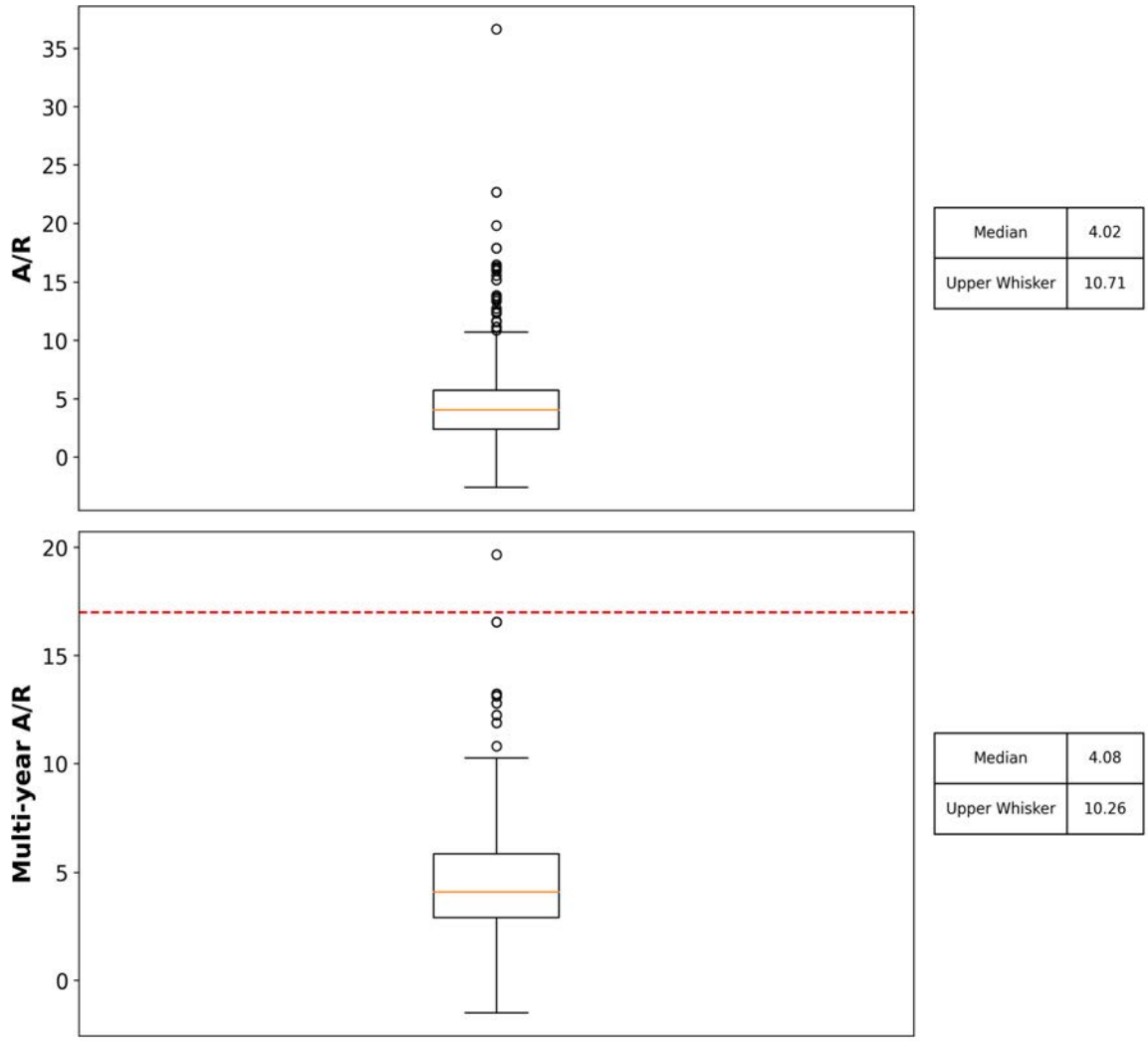
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	701	24718.38	4.57	3.7	0.0	36.65	--	--
A-R	701	24718.38	65.24	49.07	-78.4	259.73	--	--
Multi-year A/R	310	12428.22	4.97	3.22	0.0	19.67	16.99	1
Multi-year A-R	310	12428.22	223.2	119.33	-70.62	695.37	--	--

Figure 30-1. Histogram of A/R for PRUNE fields in the Coalition.



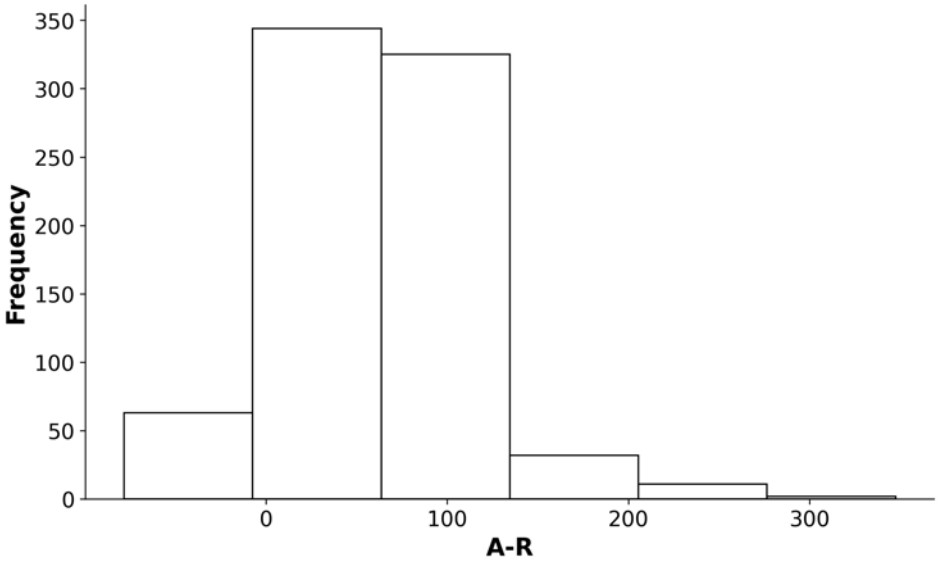
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 30-2. Box and whisker plot of A/R for PRUNE fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 30-3. Histogram of A-R for PRUNE fields in the Coalition.



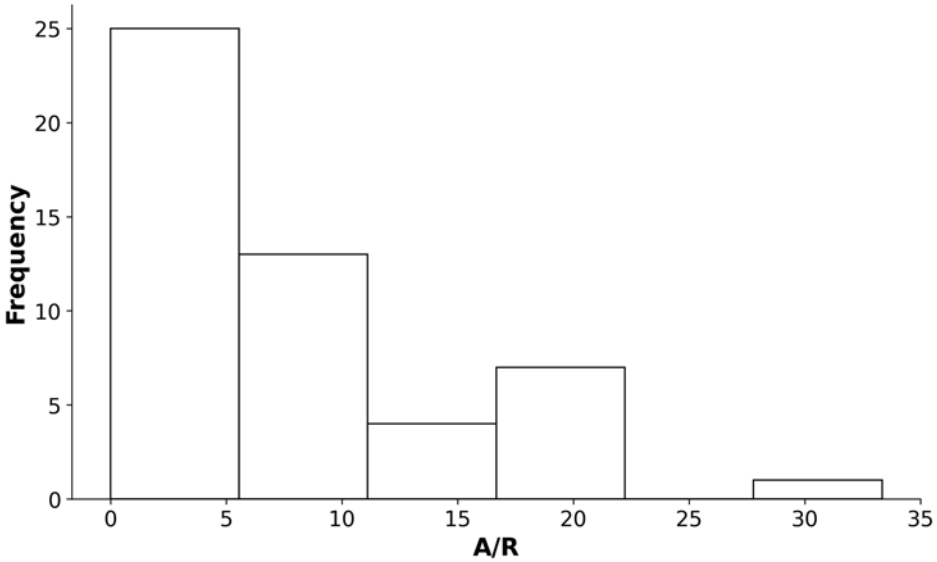
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

31. PRUNE-YOUNG

Table 31-1. Summary statistics for PRUNE-YOUNG fields in Coalition.

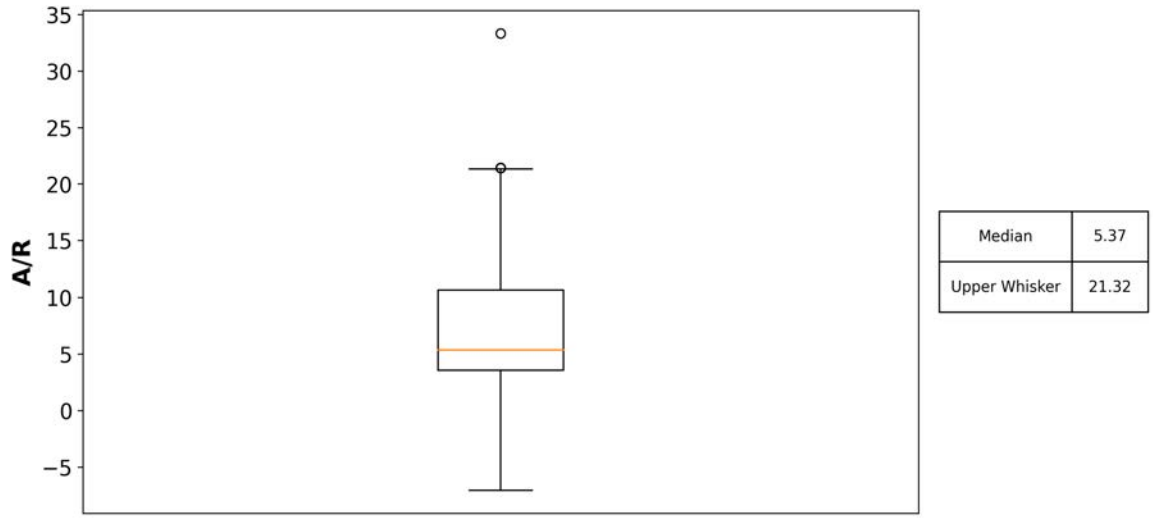
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	50	2113.84	8.35	7.27	0.0	33.33	--	--
A-R	50	2113.84	103.65	69.5	-20.22	271.6	--	--

Figure 31-1. Histogram of A/R for PRUNE-YOUNG fields in the Coalition.



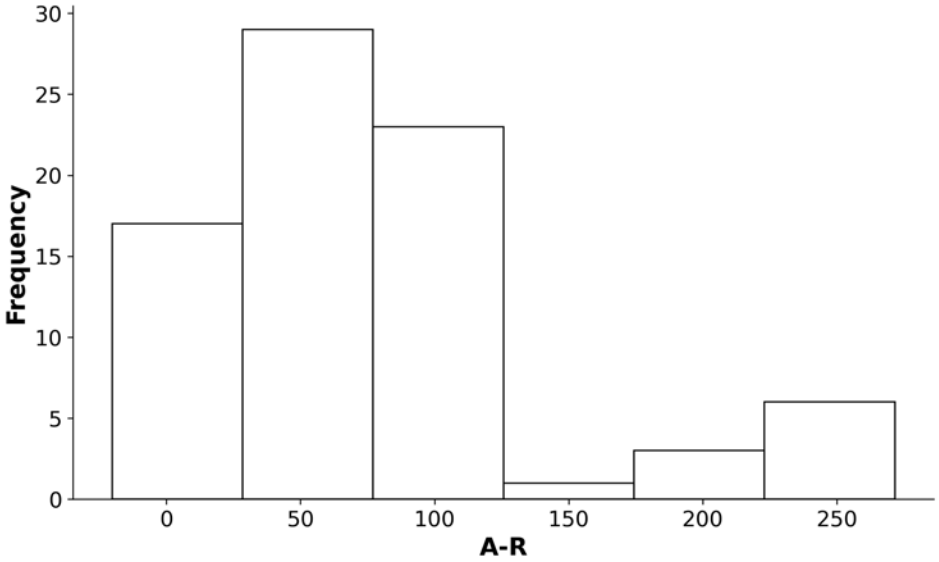
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 31-2. Box and whisker plot of A/R for PRUNE-YOUNG fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 31-3. Histogram of A-R for PRUNE-YOUNG fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

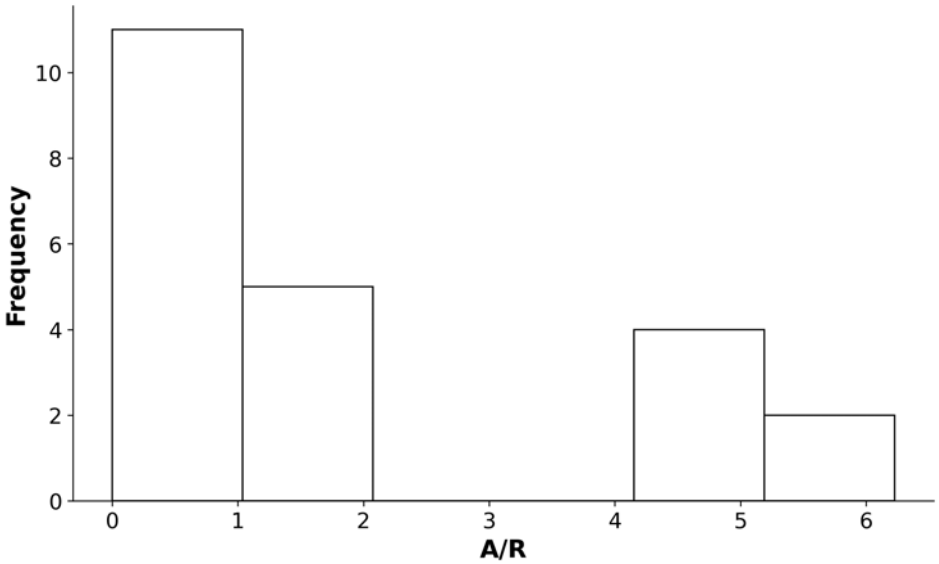
32. PUMPKIN

Table 32-1. Summary statistics for PUMPKIN fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	22	360.55	1.98	2.04	0.0	6.23	11.74	0
A-R	22	360.55	31.63	102.41	-97.6	258.4	--	--

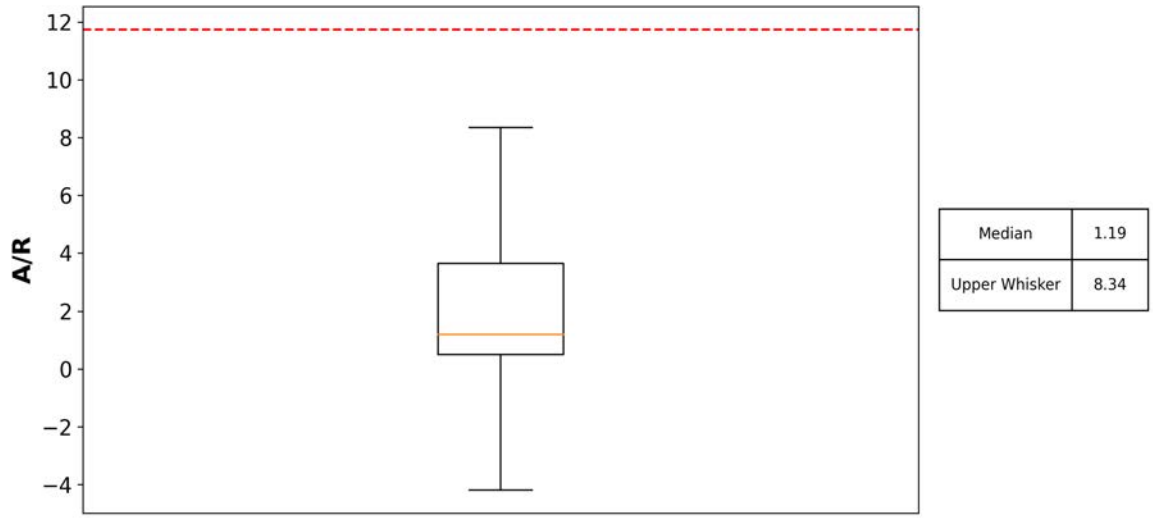
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 32-1. Histogram of A/R for PUMPKIN fields in the Coalition.



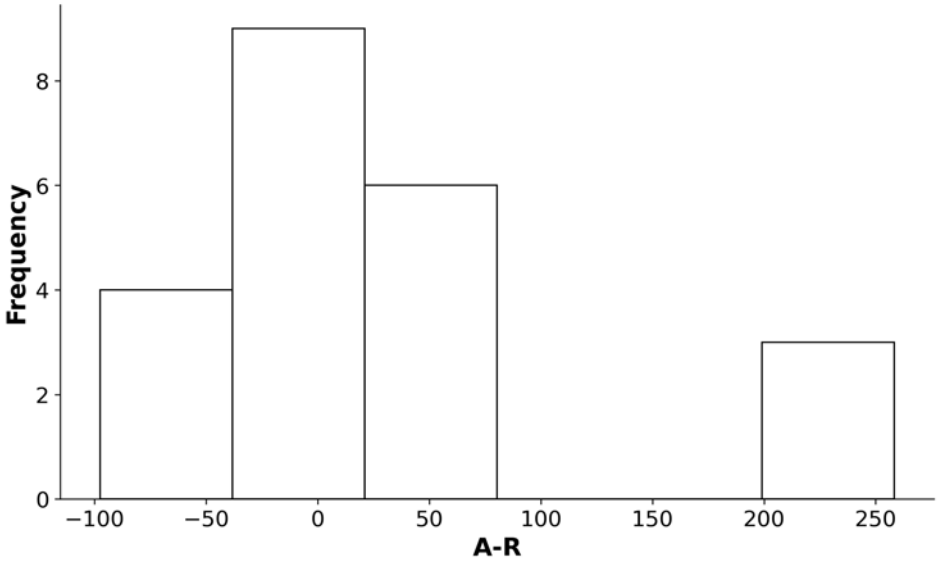
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 32-2. Box and whisker plot of A/R for PUMPKIN fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 32-3. Histogram of A-R for PUMPKIN fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

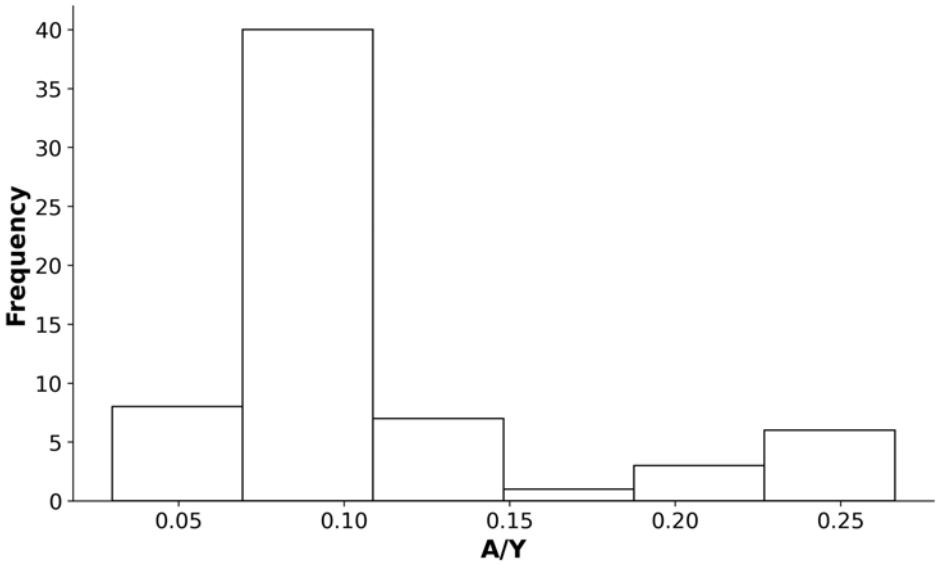
33. RICE - WILD

Table 33-1. Summary statistics for RICE - WILD fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	65	4588.7	0.11	0.06	0.03	0.27	--	--

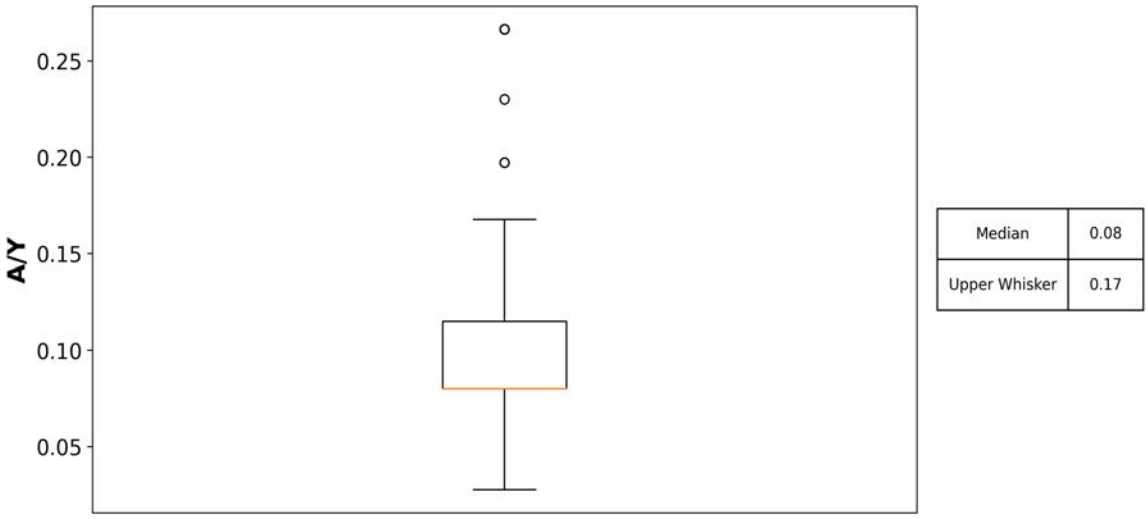
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 33-1. Histogram of A/Y for RICE - WILD fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 33-2. Box and whisker plot of A/Y for RICE - WILD fields in the Coalition.



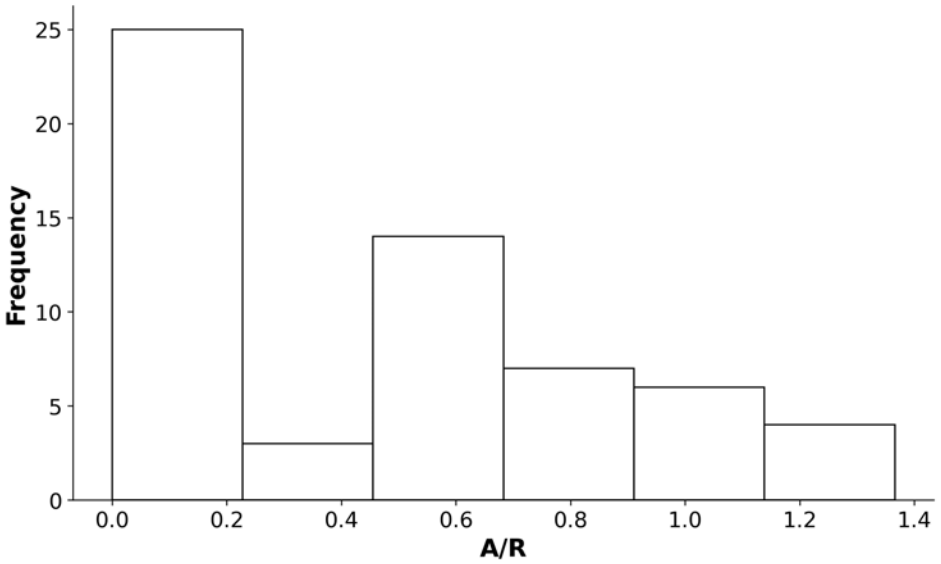
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

34. RYEGRASS - HAY

Table 34-1. Summary statistics for RYEGRASS - HAY fields in Coalition.

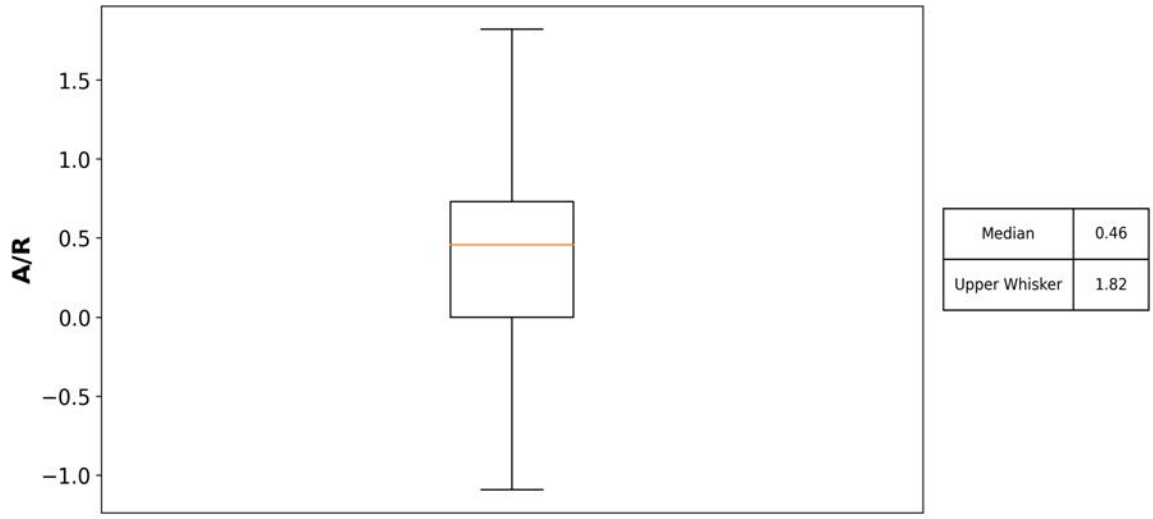
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	59	2195.12	0.42	0.41	0.0	1.37	--	--
A-R	59	2195.12	-101.06	89.91	-384.3	40.2	--	--
Multi-year A/R	3	129.9	0.19	0.19	0.0	0.39	--	--
Multi-year A-R	3	129.9	-409.29	106.34	-497.47	-291.2	--	--

Figure 34-1. Histogram of A/R for RYEGRASS - HAY fields in the Coalition.



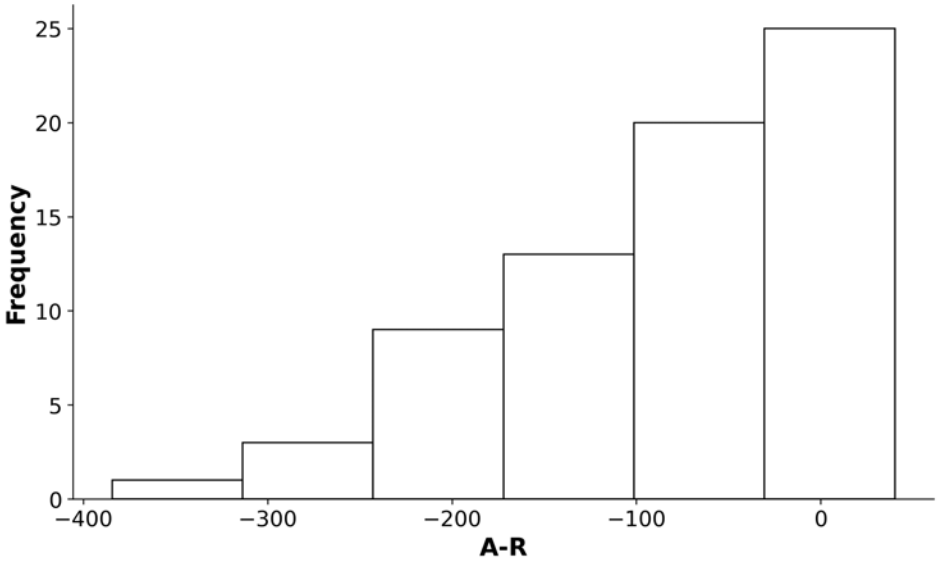
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 34-2. Box and whisker plot of A/R for RYEGRASS - HAY fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 34-3. Histogram of A-R for RYEGRASS - HAY fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

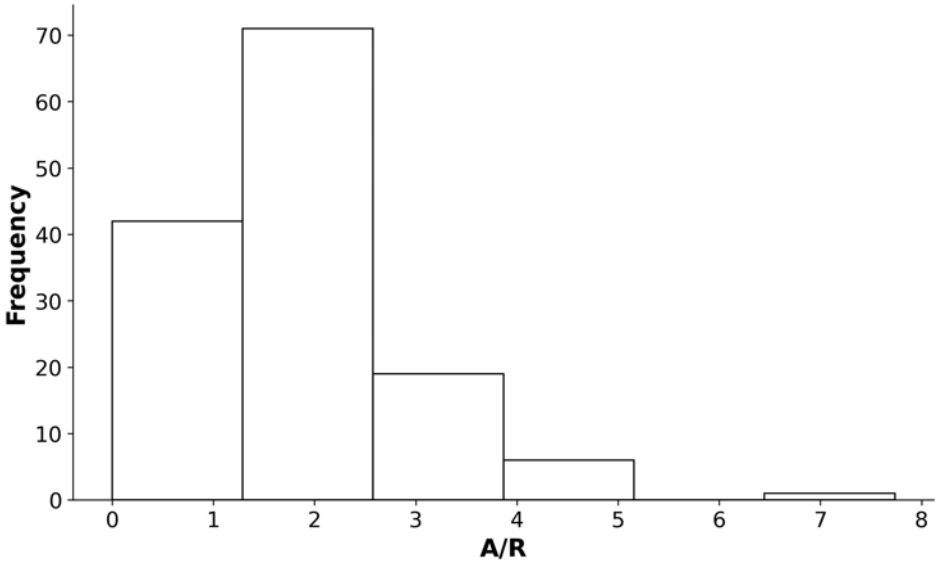
35. SAFFLOWER

Table 35-1. Summary statistics for SAFFLOWER fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	139	6899.15	1.92	1.02	0.0	7.74	5.33	0
A-R	139	6899.15	38.42	52.86	-258.5	292.28	--	--

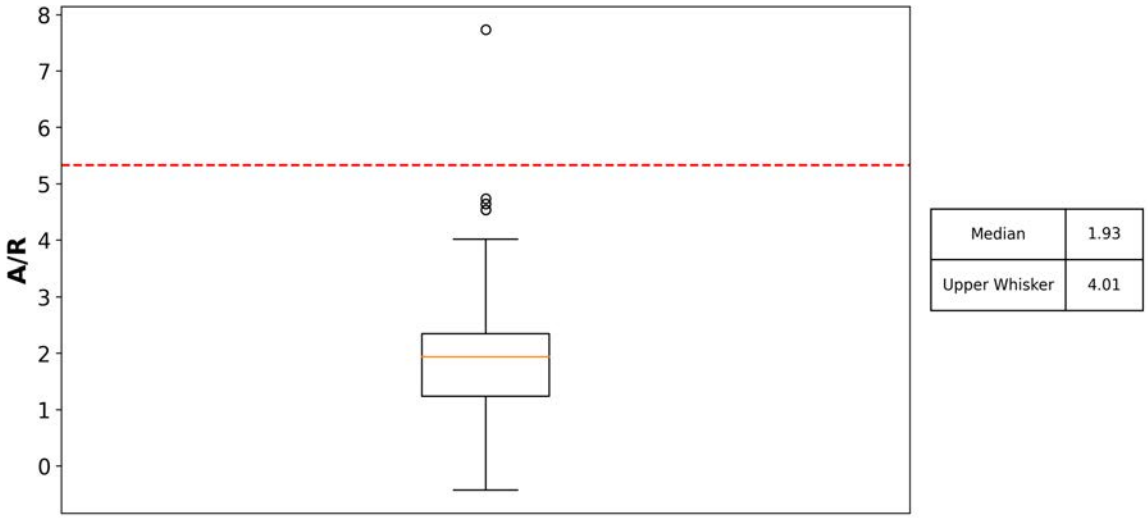
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 35-1. Histogram of A/R for SAFFLOWER fields in the Coalition.



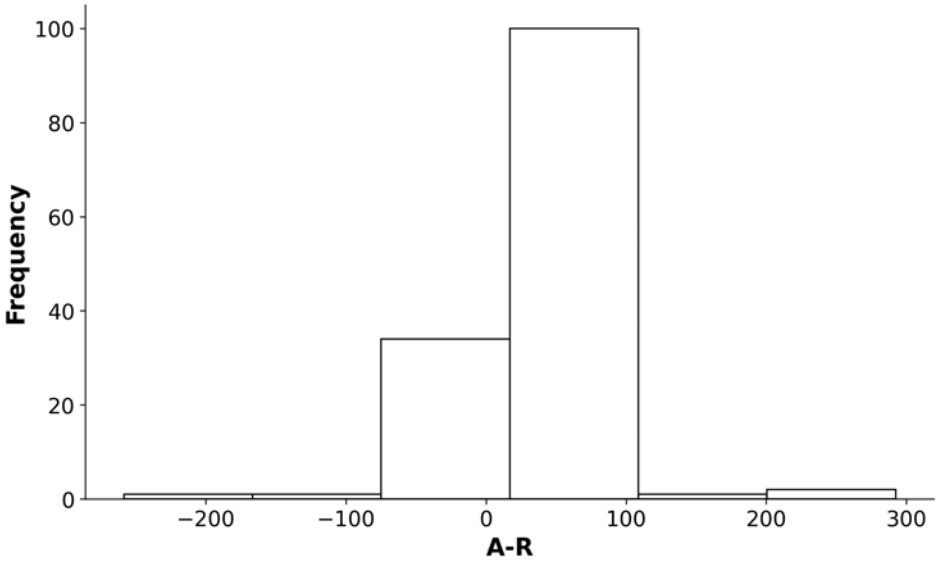
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 35-2. Box and whisker plot of A/R for SAFFLOWER fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 35-3. Histogram of A-R for SAFFLOWER fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

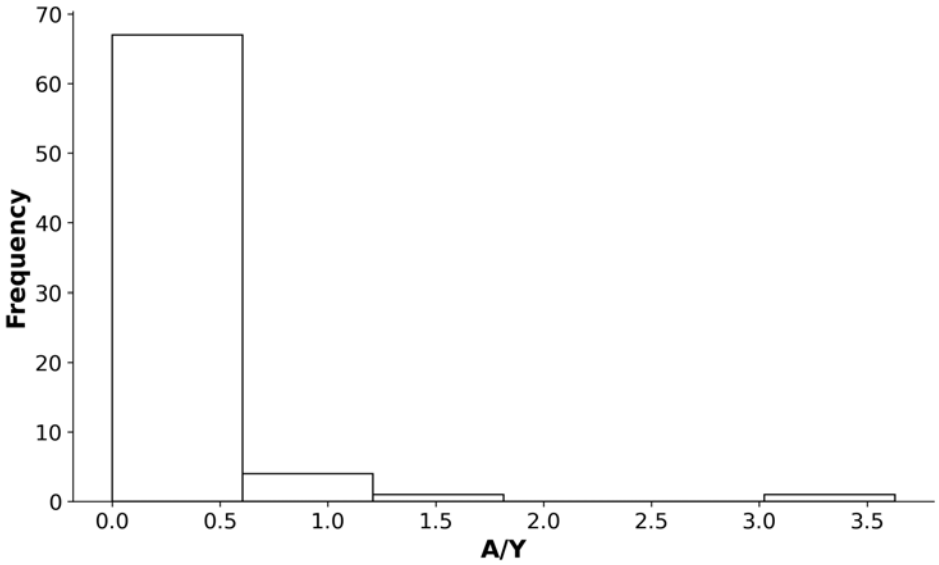
36. SEED CROP

Table 36-1. Summary statistics for SEED CROP fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	73	2467.74	0.3	0.49	0.0	3.63	--	--

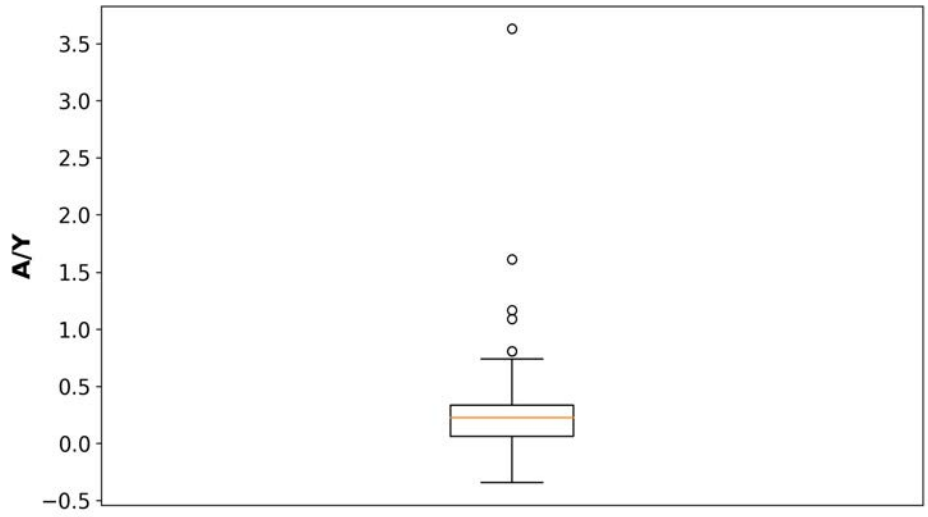
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 36-1. Histogram of A/Y for SEED CROP fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 36-2. Box and whisker plot of A/Y for SEED CROP fields in the Coalition.



Median	0.22
Upper Whisker	0.74

Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

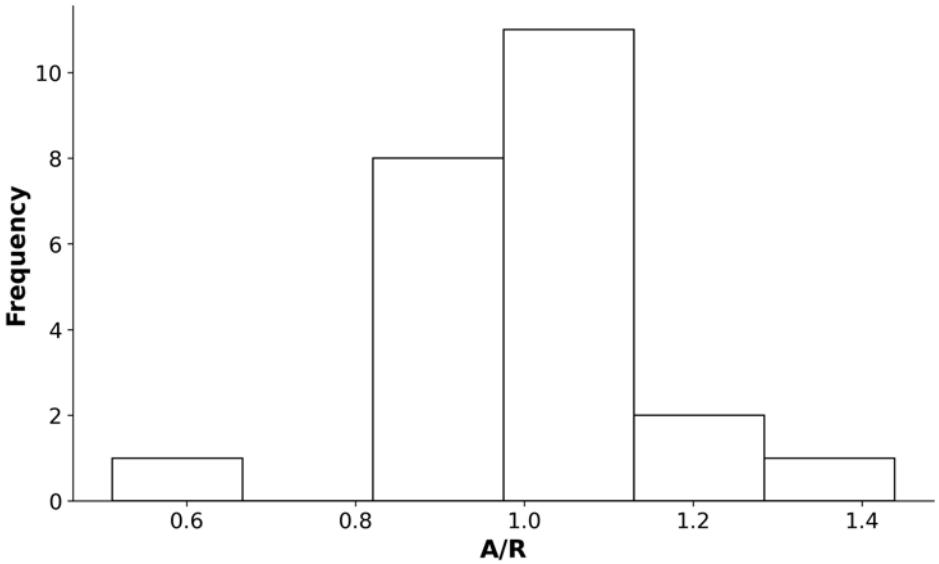
37. SORGHUM/MILO - GRAIN

Table 37-1. Summary statistics for SORGHUM/MILO - GRAIN fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	29	1447.68	1.18	1.51	0.0	8.65	3.33	0
A-R	29	1447.68	-1.05	61.98	-113.85	252.0	--	--

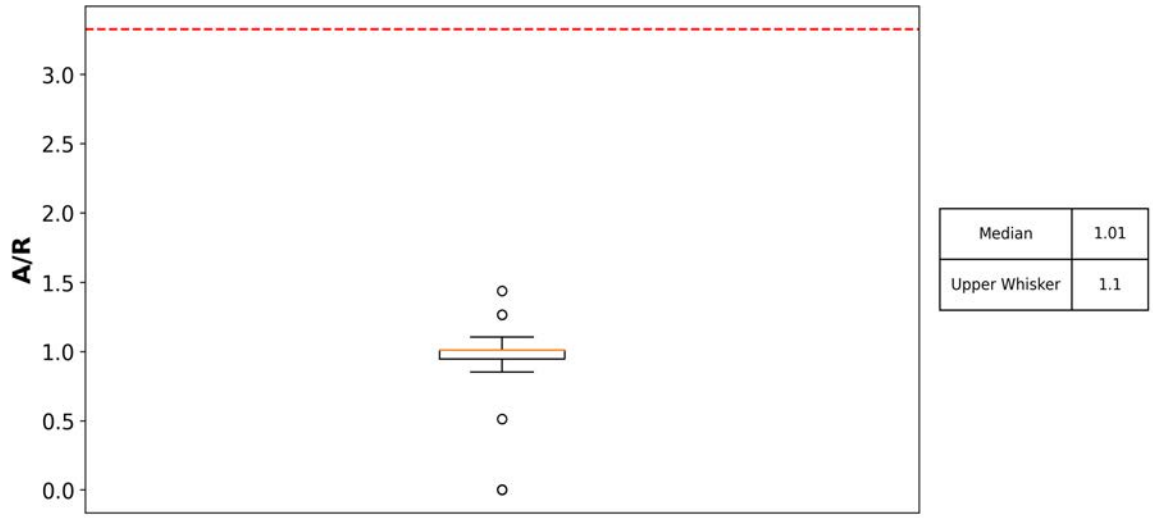
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 37-1. Histogram of A/R for SORGHUM/MILO - GRAIN fields in the Coalition.



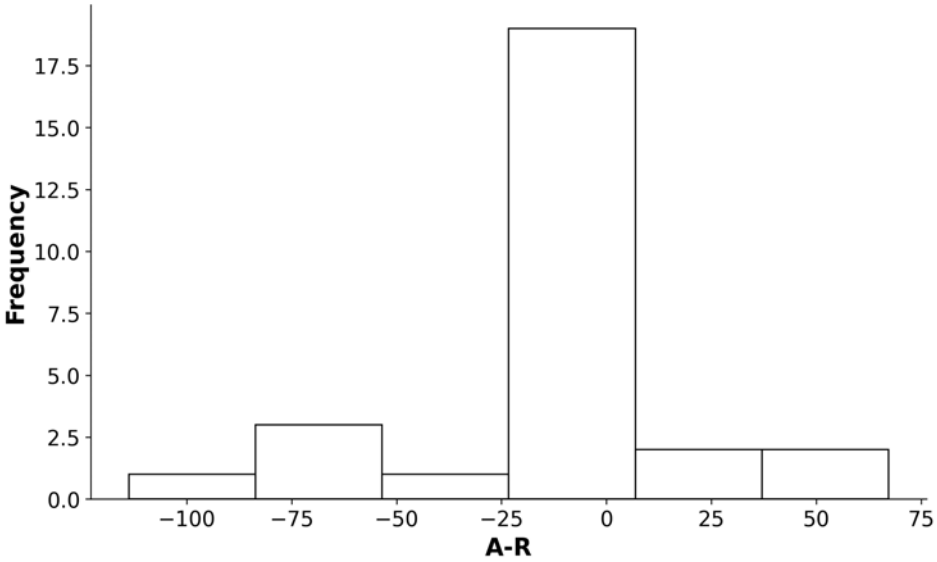
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 37-2. Box and whisker plot of A/R for SORGHUM/MILO - GRAIN fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 37-3. Histogram of A-R for SORGHUM/MILO - GRAIN fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

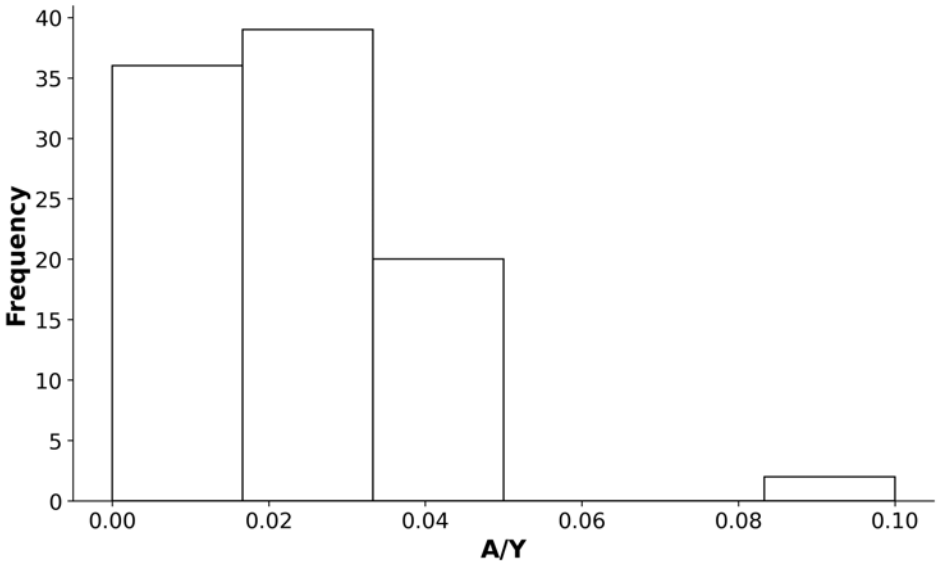
38. SUDAN GRASS - HAY

Table 38-1. Summary statistics for SUDAN GRASS - HAY fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	97	8144.79	0.02	0.02	0.0	0.1	--	--

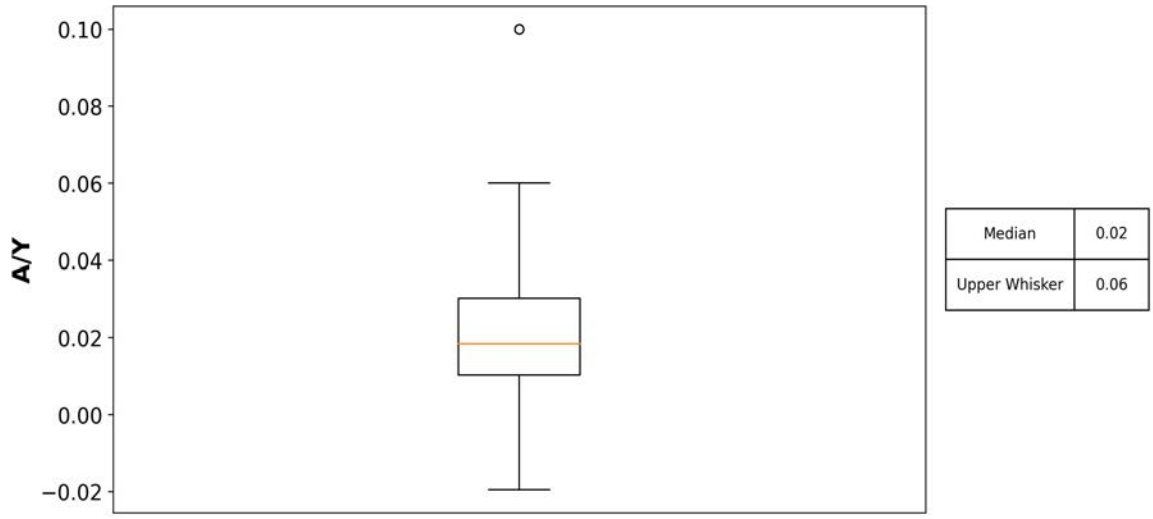
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 38-1. Histogram of A/Y for SUDAN GRASS - HAY fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 38-2. Box and whisker plot of A/Y for SUDAN GRASS - HAY fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

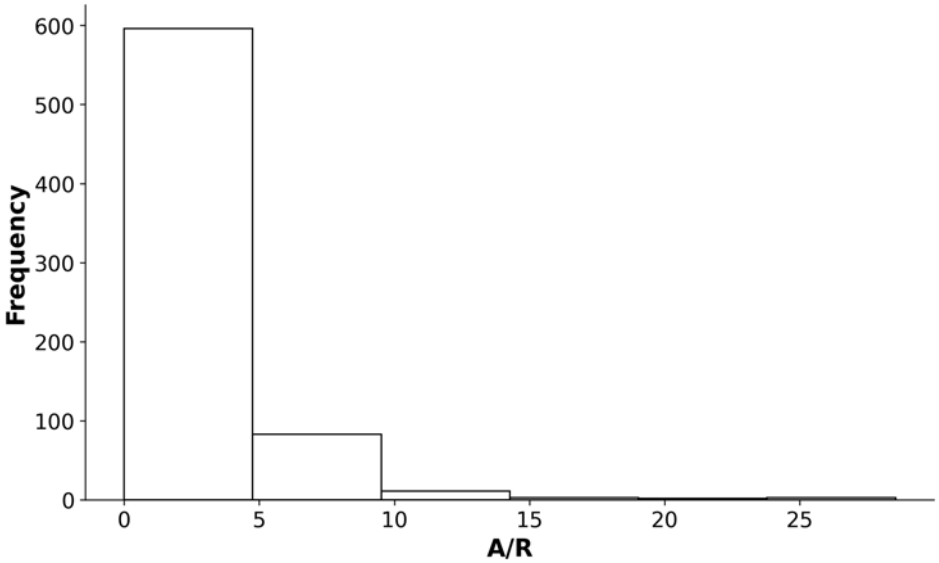
39. SUNFLOWER

Table 39-1. Summary statistics for SUNFLOWER fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	698	37280.24	3.42	2.78	0.0	28.54	9.85	4
A-R	698	37280.24	60.57	42.33	-189.6	248.94	--	--

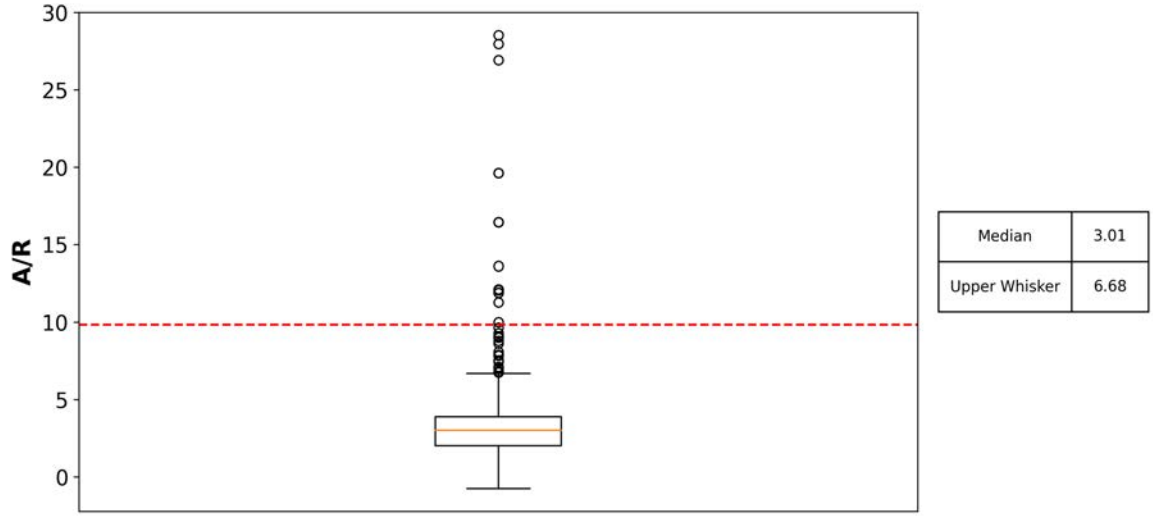
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 39-1. Histogram of A/R for SUNFLOWER fields in the Coalition.



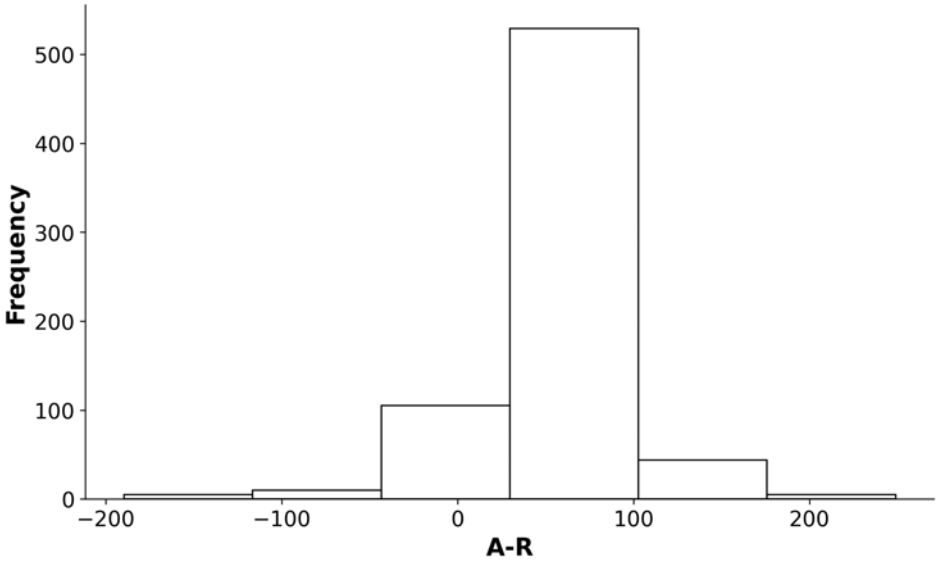
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 39-2. Box and whisker plot of A/R for SUNFLOWER fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 39-3. Histogram of A-R for SUNFLOWER fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

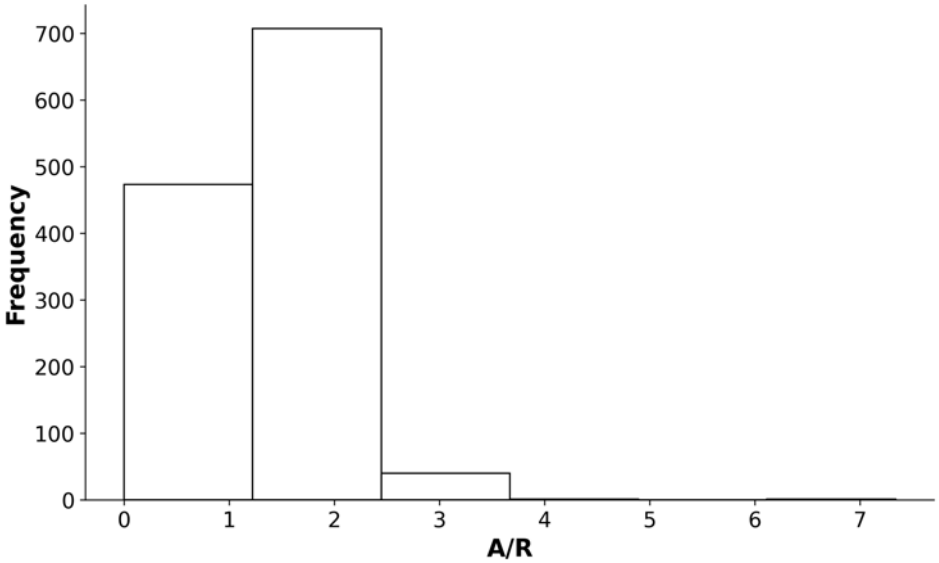
40. TOMATO - PROCESSING

Table 40-1. Summary statistics for TOMATO - PROCESSING fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	1245	67145.61	1.65	1.89	0.0	19.41	2.84	1
A-R	1245	67145.61	58.39	67.84	-151.84	323.9	--	--

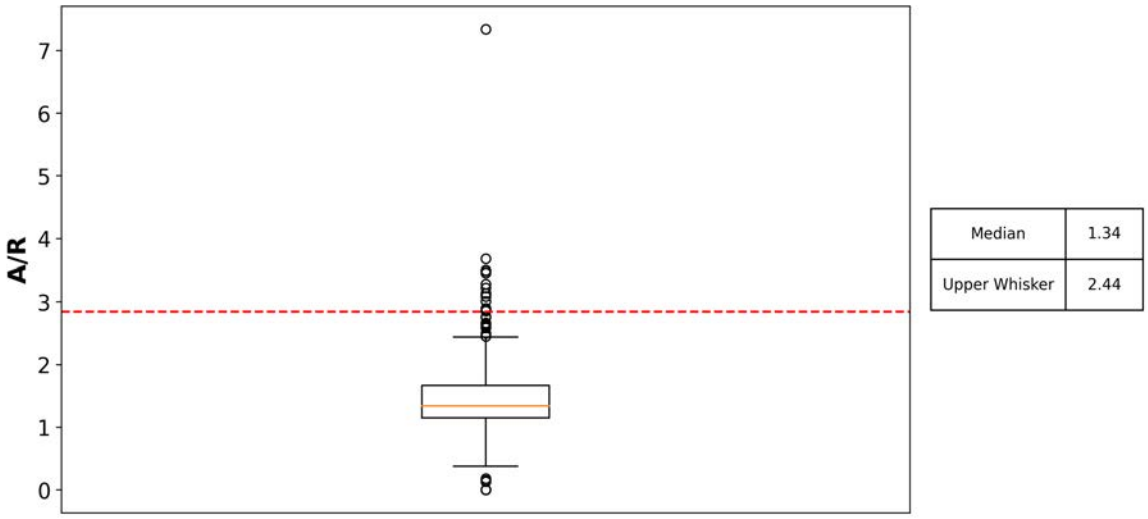
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 40-1. Histogram of A/R for TOMATO - PROCESSING fields in the Coalition.



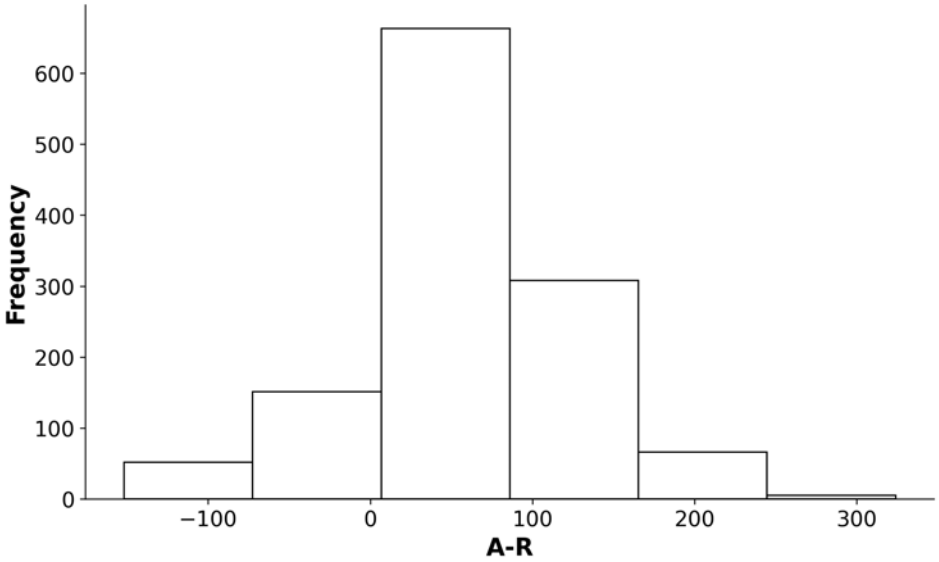
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 40-2. Box and whisker plot of A/R for TOMATO - PROCESSING fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 40-3. Histogram of A-R for TOMATO - PROCESSING fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

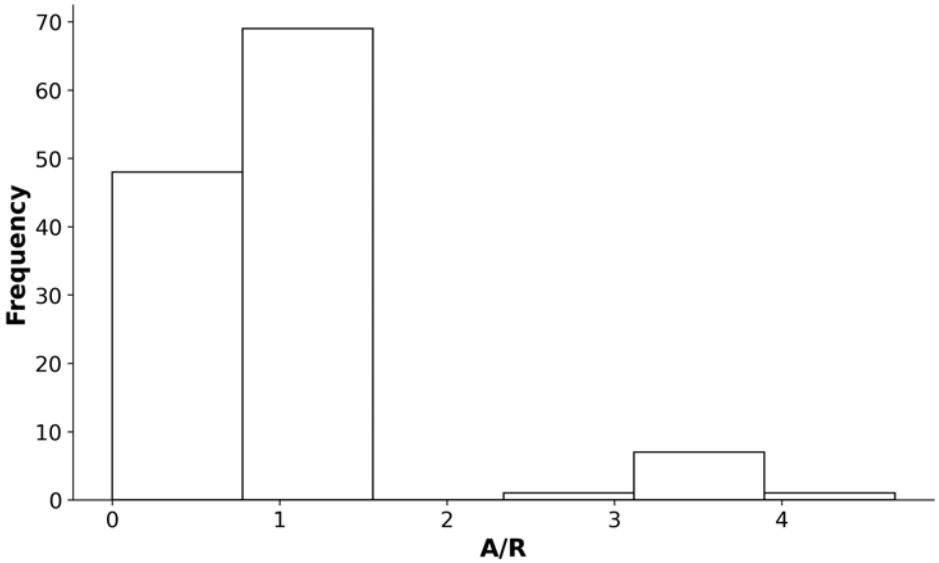
41. TRITICALE - GRAIN

Table 41-1. Summary statistics for TRITICALE - GRAIN fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	126	6062.04	1.01	0.85	0.0	4.68	1.84	0
A-R	126	6062.04	-13.81	51.98	-141.4	133.64	--	--

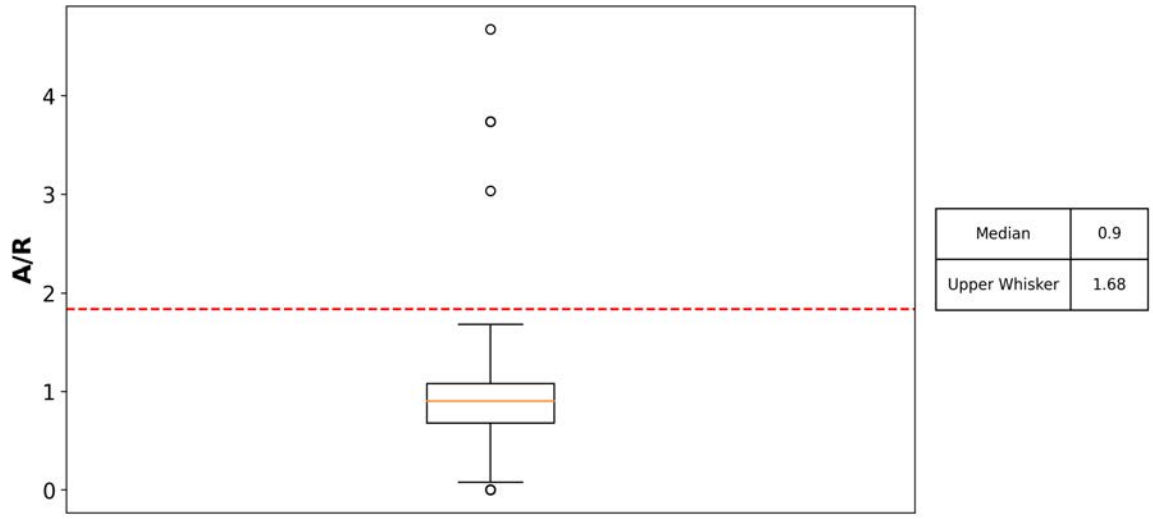
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 41-1. Histogram of A/R for TRITICALE - GRAIN fields in the Coalition.



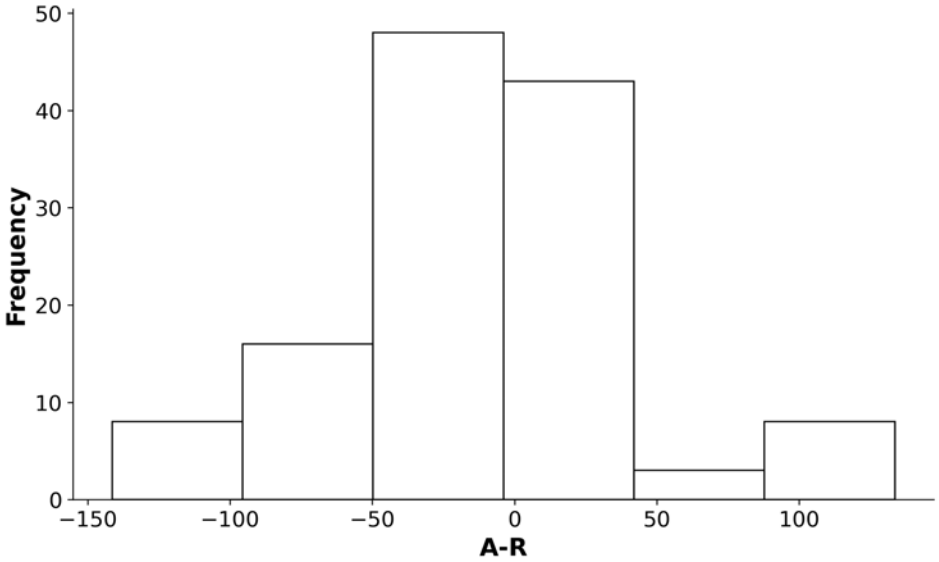
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 41-2. Box and whisker plot of A/R for TRITICALE - GRAIN fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 41-3. Histogram of A-R for TRITICALE - GRAIN fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

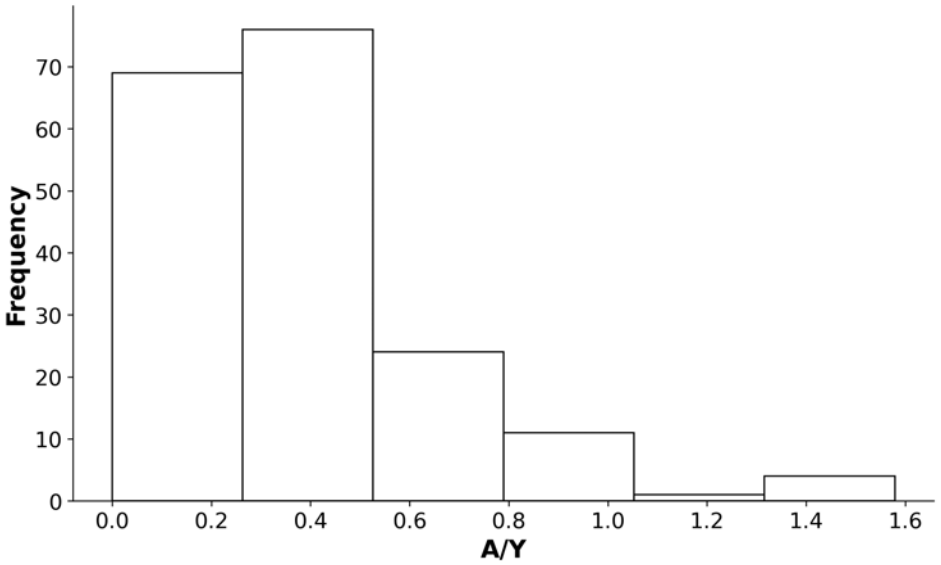
42. VINE SEED

Table 42-1. Summary statistics for VINE SEED fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	188	6583.36	0.44	0.61	0.0	6.18	--	--

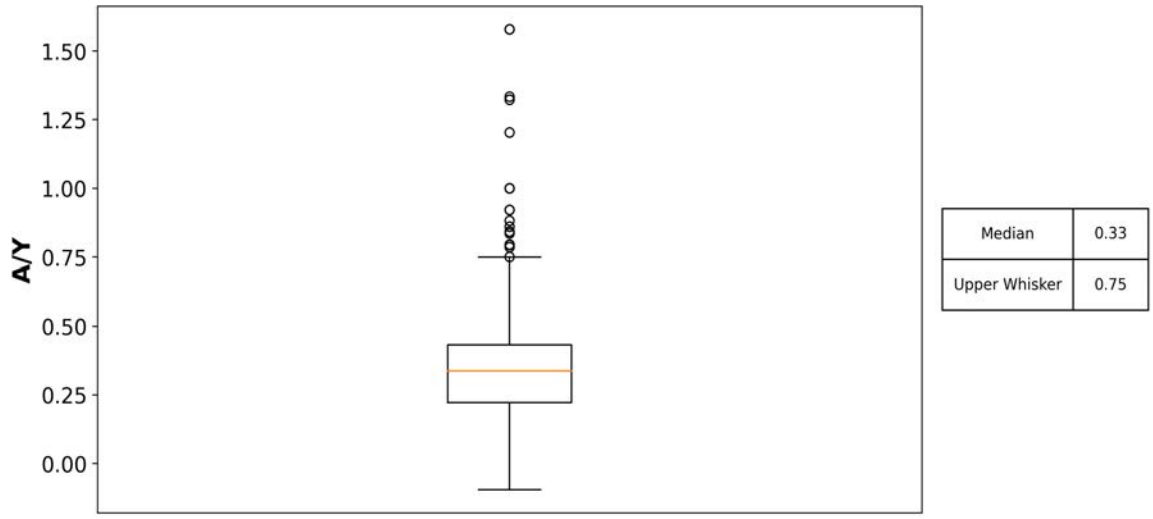
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 42-1. Histogram of A/Y for VINE SEED fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 42-2. Box and whisker plot of A/Y for VINE SEED fields in the Coalition.



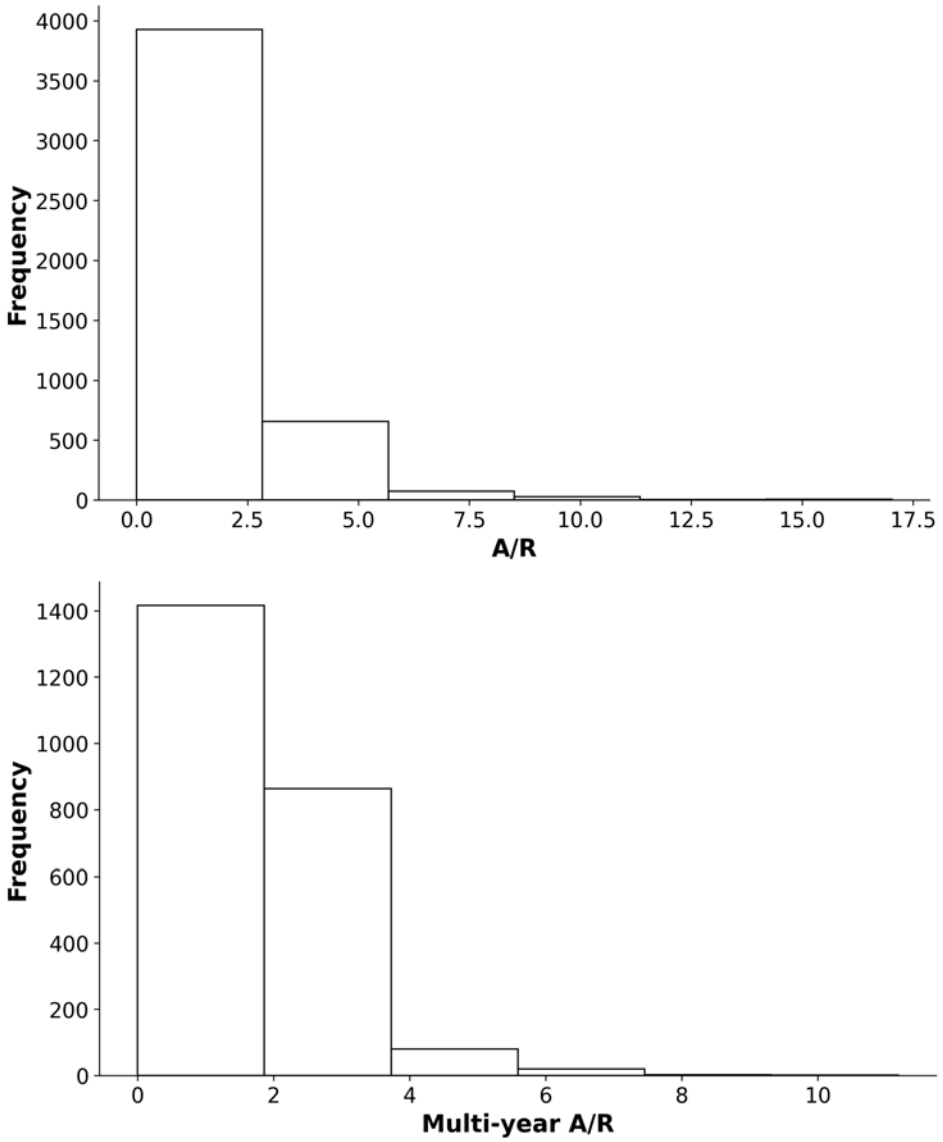
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

43. WALNUT

Table 43-1. Summary statistics for WALNUT fields in Coalition.

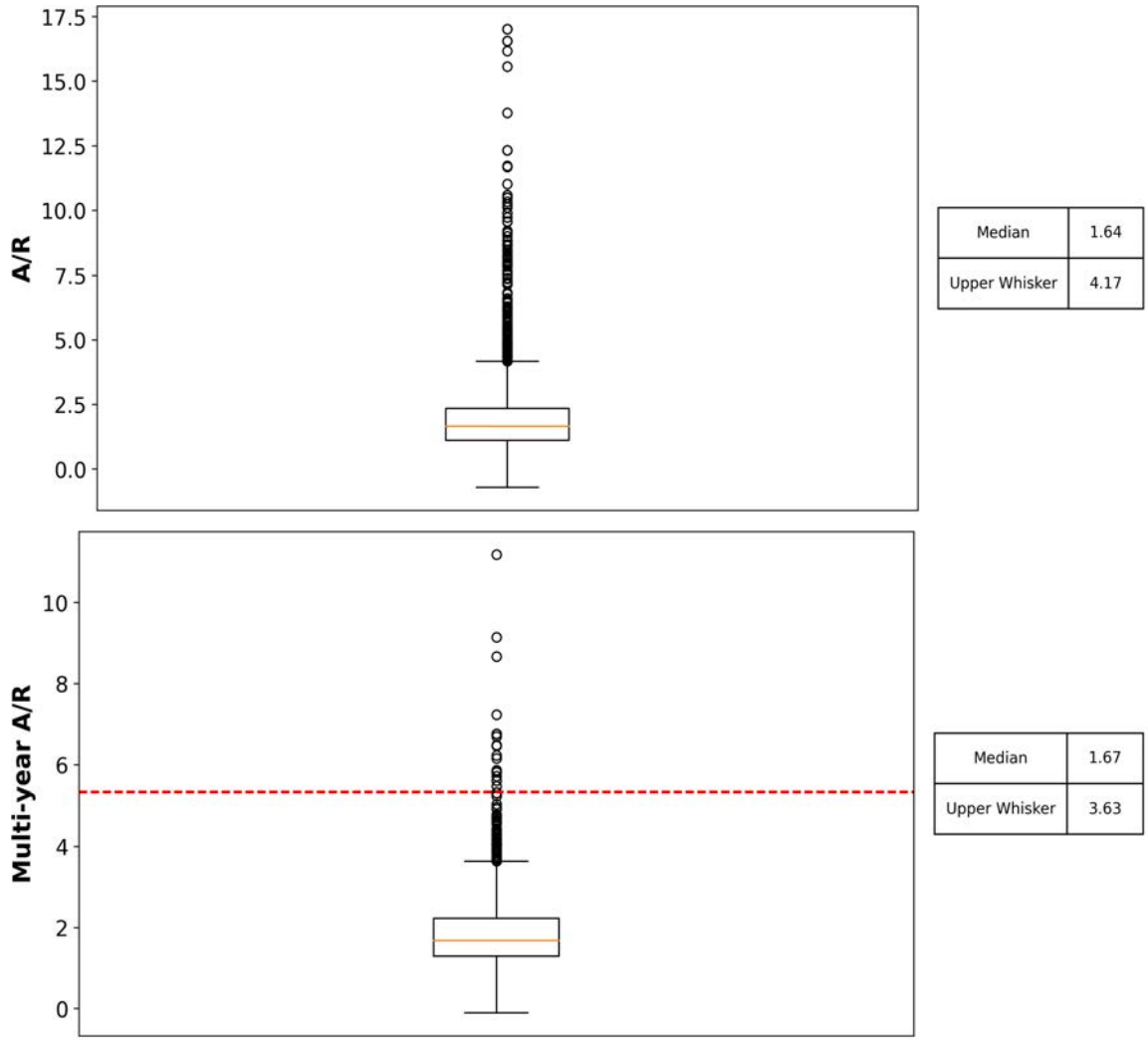
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	4666	177286.83	1.91	1.57	0.0	20.59	--	--
A-R	4666	177286.83	41.61	56.09	-206.7	357.77	--	--
Multi-year A/R	2383	94593.27	1.85	1.03	0.0	16.15	5.33	25
Multi-year A-R	2383	94593.27	143.75	141.76	-268.95	883.76	--	--

Figure 43-1. Histogram of A/R for WALNUT fields in the Coalition.



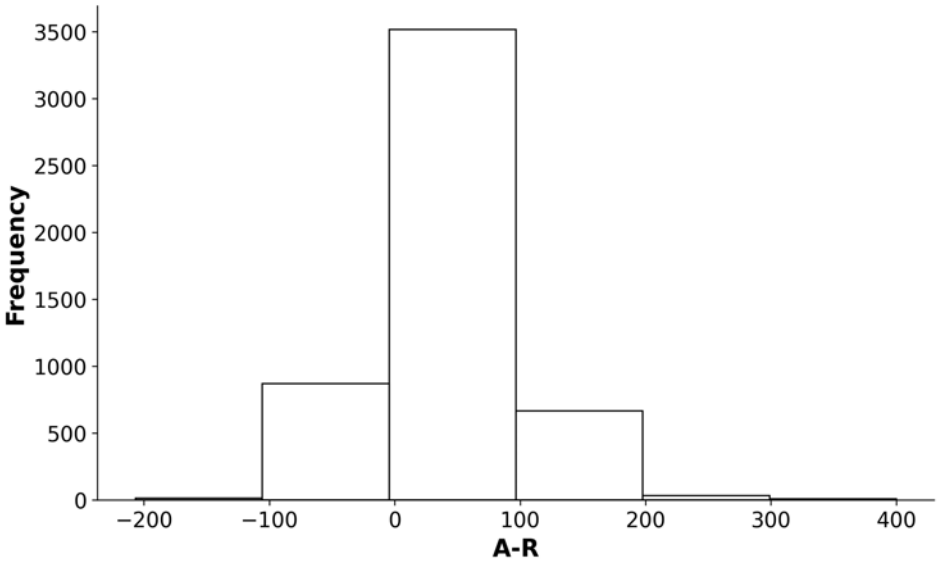
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 43-2. Box and whisker plot of A/R for WALNUT fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 43-3. Histogram of A-R for WALNUT fields in the Coalition.



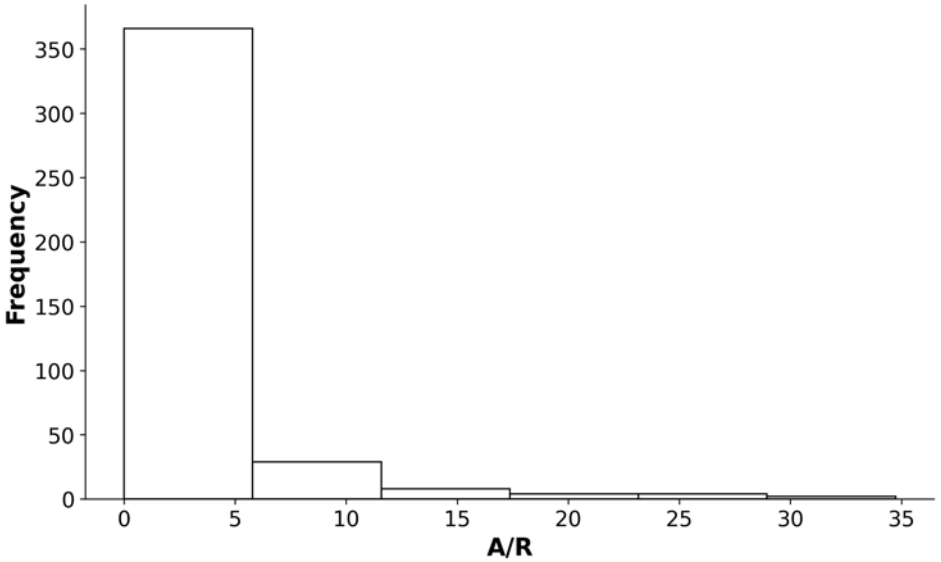
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

44. WALNUT-YOUNG

Table 44-1. Summary statistics for WALNUT-YOUNG fields in Coalition.

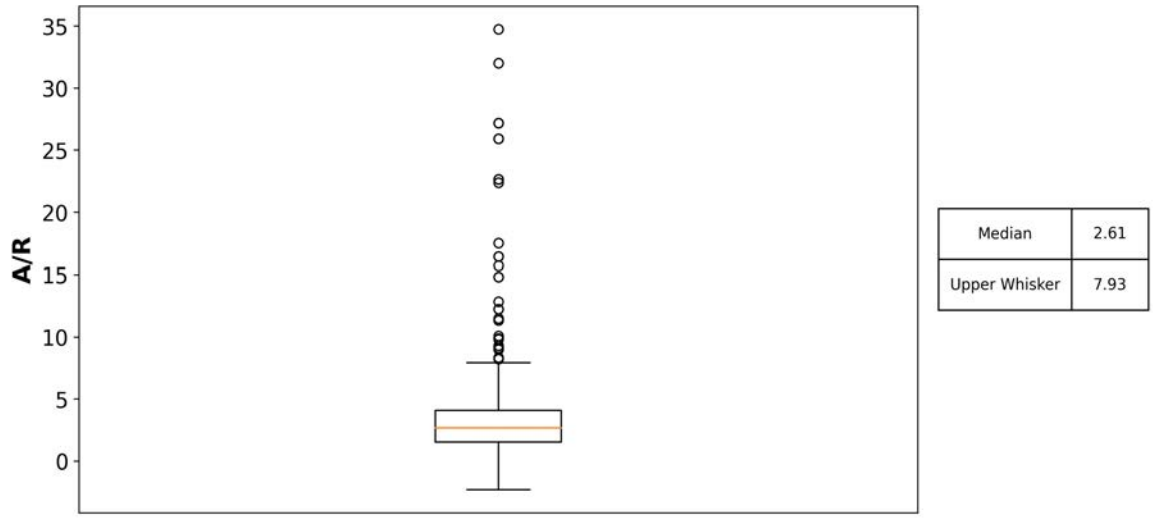
Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	402	18029.26	3.35	3.71	0.0	27.16	--	--
A-R	402	18029.26	56.58	55.31	-71.55	282.2	--	--

Figure 44-1. Histogram of A/R for WALNUT-YOUNG fields in the Coalition.



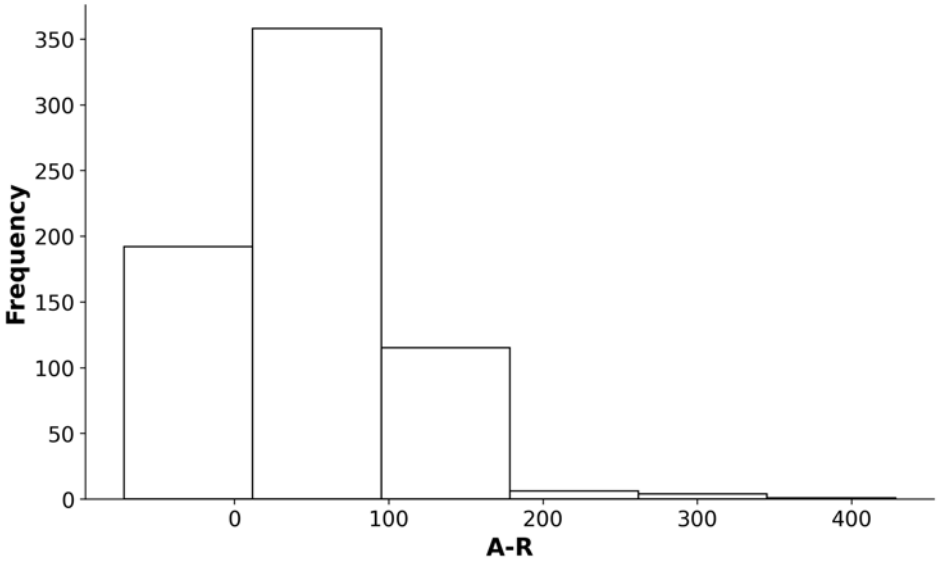
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 44-2. Box and whisker plot of A/R for WALNUT-YOUNG fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Any dots that exceed the red dashed line were outliers.

Figure 44-3. Histogram of A-R for WALNUT-YOUNG fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

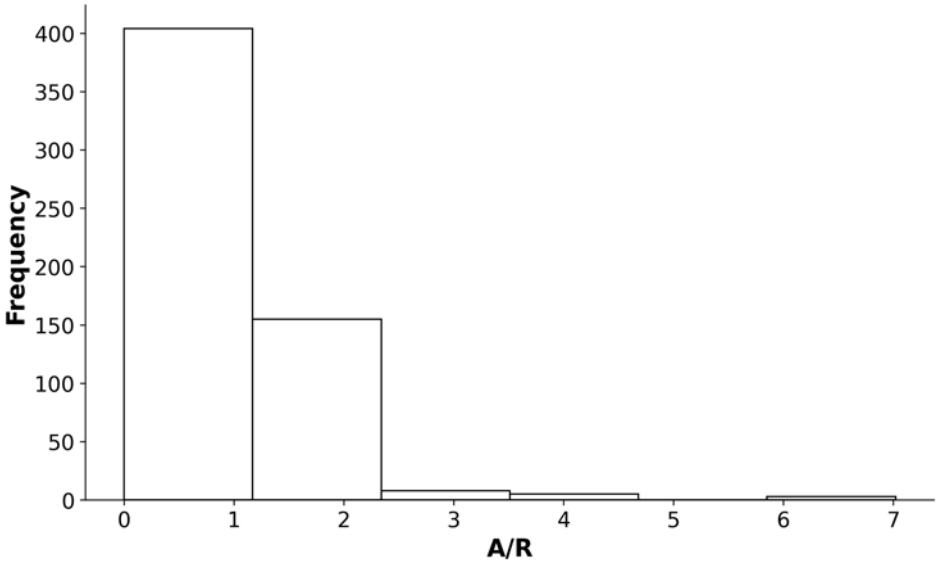
45. WHEAT - GRAIN

Table 45-1. Summary statistics for WHEAT - GRAIN fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/R	575	28918.17	0.99	0.73	0.0	7.02	2.59	0
A-R	575	28918.17	-12.6	53.53	-330.0	172.7	--	--

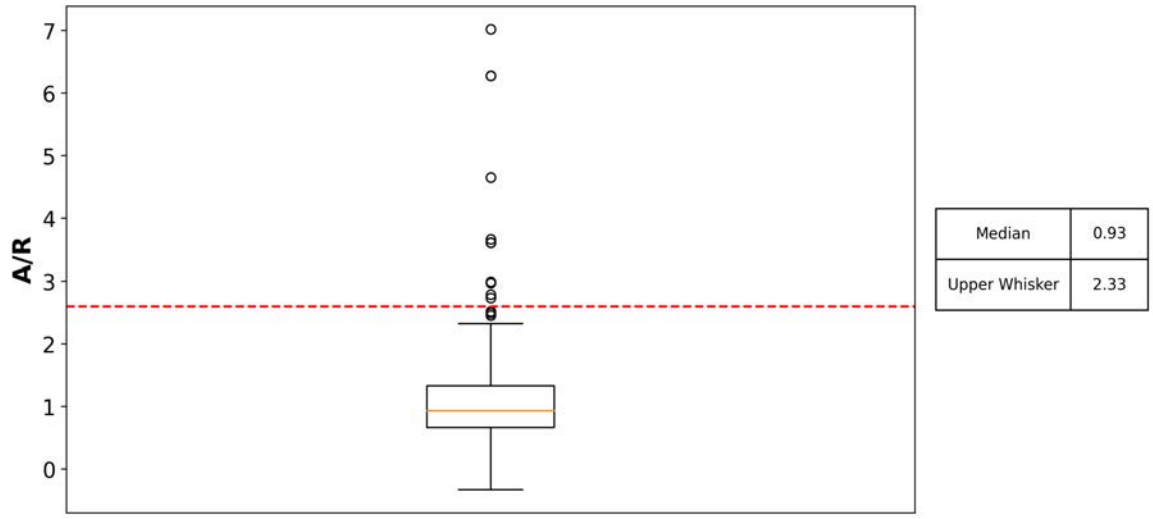
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 45-1. Histogram of A/R for WHEAT - GRAIN fields in the Coalition.



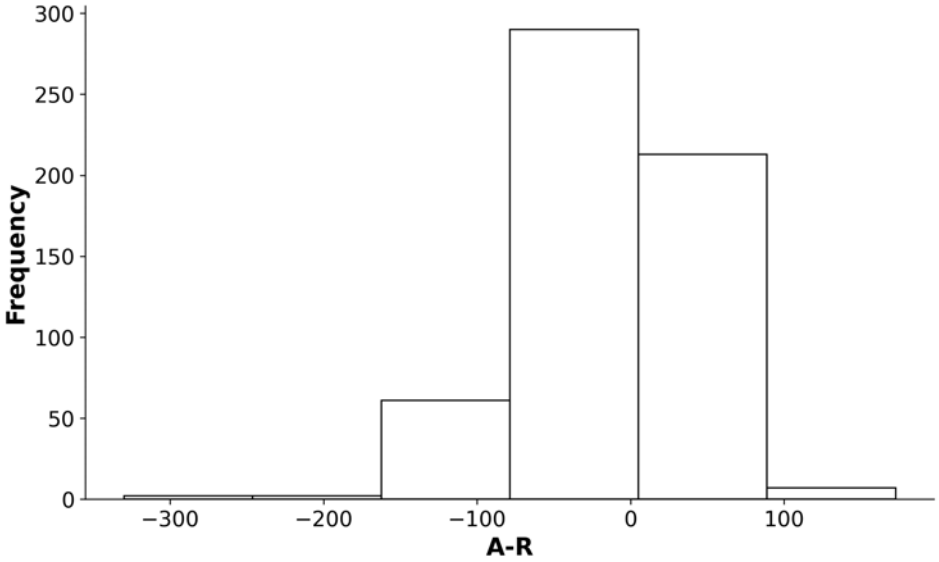
Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

Figure 45-2. Box and whisker plot of A/R for WHEAT - GRAIN fields in the Coalition.



The boxplot uses the standard method of Tukey (1977), and values greater than 3 times the difference between the upper and lower whisker are not shown to avoid skewing the plot. The red dashed line shows the outlier threshold which was calculated via the adjusted boxplot method of Hubert and Vandervieren (2008) using pooled 2019 – 2021 single year ratios. Outliers for 2021 CY annual crop fields are any dots above the red dashed line that were also outliers in either the 2020 or 2019 CY for any crop.

Figure 45-3. Histogram of A-R for WHEAT - GRAIN fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot.

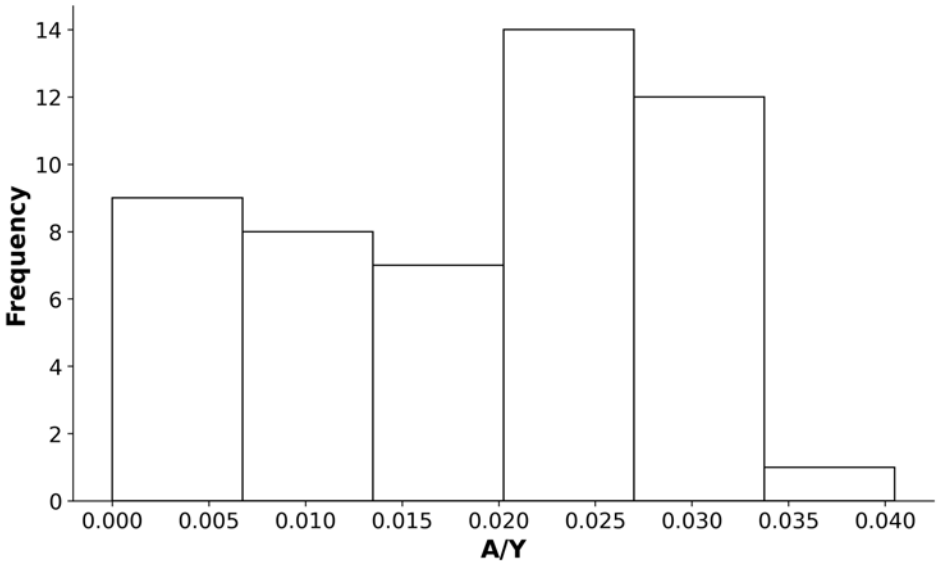
46. WHEAT - HAY

Table 46-1. Summary statistics for WHEAT - HAY fields in Coalition.

Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max	Outlier Threshold	No. Outliers
A/Y	51	4490.73	0.02	0.01	0.0	0.04	--	--

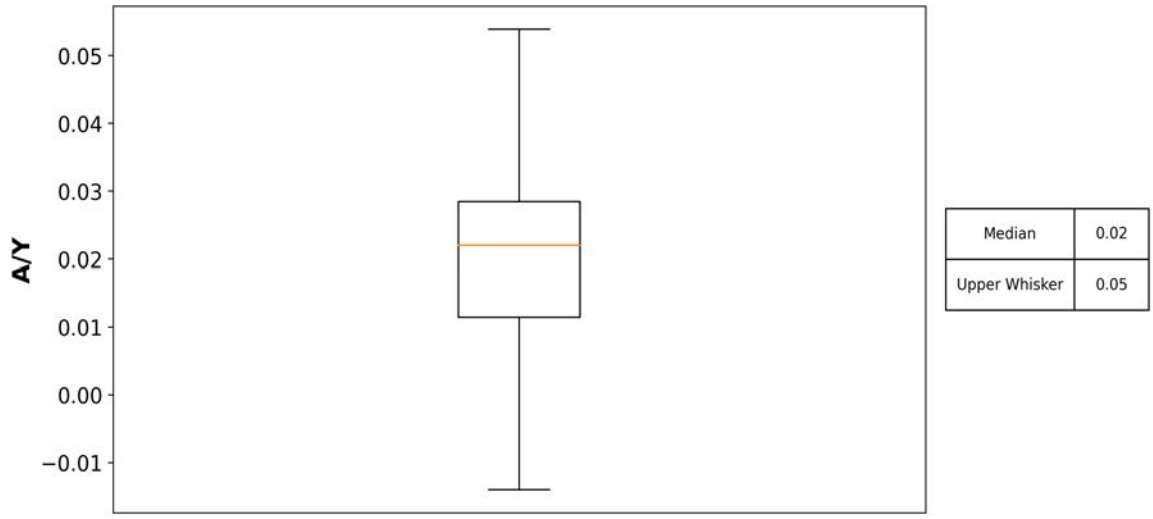
Outliers for annual crops are single year outliers in 2021 and either 2020 or 2019.

Figure 46-1. Histogram of A/Y for WHEAT - HAY fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot

Figure 46-2. Box and whisker plot of A/Y for WHEAT - HAY fields in the Coalition.



Values greater than 3 times the difference between the upper and lower whisker not shown to avoid skewing of plot. The whiskers are the medcouple values with the upper whisker being the outlier threshold. Dots are outliers.

47. OTHER CROPS

Table 47-1. Summary statistics for crops with limited representation in the Coalition

Crops with limited data (less than 20 fields for 2021 CY) or non-specific crop categories (“other” or “misc”).

Crop	Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max
ALFALFA - SILAGE/HAYLAGE	A/R	10.0	350.0	0.68	0.37	0.2	1.04
	A-R	10.0	350.0	-50.95	63.38	-132.14	2.0
	A/Y	10.0	350.0	0.01	0.0	0.0	0.01
APRICOT/APRIUM	A/R	9.0	20.24	7.67	8.43	0.0	21.22
	A-R	9.0	20.24	38.74	48.3	-20.85	112.44
	A/Y	9.0	20.24	0.02	0.02	0.0	0.06
ASPARAGUS	A/R	3.0	117.0	4.72	2.77	1.54	6.62
	A-R	3.0	117.0	62.27	55.5	4.72	115.47
	A/Y	3.0	117.0	0.01	0.01	0.0	0.02
BARLEY - HAY	A/R						
	A-R						
	A/Y	6.0	225.18	0.0	0.0	0.0	0.01
BEAN - GREEN	A/R	11.0	626.19	3.9	1.83	0.0	4.72
	A-R	11.0	626.19	65.8	45.49	-42.2	85.94
	A/Y	11.0	626.19	0.01	0.01	0.0	0.01
BEET	A/R						
	A-R						
	A/Y	2.0	31.66	0.07	0.0	0.07	0.07
BERRY	A/R						
	A-R						
	A/Y	18.0	92.89	0.05	0.11	0.0	0.47
BROCCOLI	A/R	1.0	2.7	0.17		0.17	0.17
	A-R	1.0	2.7	-46.5		-46.5	-46.5
	A/Y	1.0	2.7	0.0		0.0	0.0
CABBAGE	A/R						
	A-R						
	A/Y	1.0	0.34	160.0		160.0	160.0
CHERRY-YOUNG	A/R	2.0	93.0	2.06	0.03	2.04	2.08
	A-R	2.0	93.0	18.26	0.87	17.65	18.88
	A/Y	2.0	93.0	0.0	0.0	0.0	0.0

Crop	Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max
CHESTNUT	A/R						
	A-R						
	A/Y	9.0	66.48	0.04	0.04	0.0	0.1
CILANTRO	A/R						
	A-R						
	A/Y	7.0	454.8	0.03	0.03	0.02	0.1
CITRUS-YOUNG	A/R	1.0	3.0	1.08		1.08	1.08
	A-R	1.0	3.0	0.51		0.51	0.51
	A/Y	1.0	3.0	0.0		0.0	0.0
CORN - NR	A/R						
	A-R						
	A/Y	1.0	16.0	0.43		0.43	0.43
CORN - POPCORN	A/R						
	A-R						
	A/Y	6.0	478.8	0.03	0.0	0.03	0.03
CORN - SWEET	A/R	11.0	291.5	5.38	2.26	1.95	9.3
	A-R	11.0	291.5	186.82	81.33	45.32	328.3
	A/Y	11.0	291.5	0.02	0.01	0.01	0.03
COTTON	A/R	19.0	1362.2	1.55	0.25	1.08	2.0
	A-R	19.0	1362.2	57.27	23.36	7.0	105.6
	A/Y	19.0	1362.2	0.1	0.02	0.07	0.12
COVER CROP	A/R						
	A-R						
	A/Y	8.0	91.1	0.01	0.01	0.0	0.01
DICHONDRA	A/R						
	A-R						
	A/Y	5.0	246.0	0.44	0.12	0.33	0.62
EGGPLANT	A/R						
	A-R						
	A/Y	1.0	1.0	0.0		0.0	0.0
FIG	A/R	11.0	186.1	26.53	49.95	0.0	175.85
	A-R	11.0	186.1	57.7	38.01	-7.52	95.65
	A/Y	11.0	186.1	0.03	0.06	0.0	0.22
FLOWER/ORNAMENTAL	A/R						
	A-R						
	A/Y	3.0	31.0	0.03	0.06	0.0	0.1

Crop	Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max
GARLIC	A/R	13.0	567.2	1.73	0.1	1.42	1.88
	A-R	13.0	567.2	80.64	10.99	44.3	84.05
	A/Y	13.0	567.2	0.01	0.0	0.01	0.01
GRAPE - OTHER	A/R						
	A-R						
	A/Y	8.0	98.0	3.95	5.45	0.0	10.53
GRAPE - TABLE	A/R	1.0	4.0	35.4		35.4	35.4
	A-R	1.0	4.0	77.74		77.74	77.74
	A/Y	1.0	4.0	0.04		0.04	0.04
GRAPE ROOTSTOCK	A/R						
	A-R						
	A/Y	9.0	321.11	0.01	0.01	0.0	0.04
HOPS	A/R						
	A-R						
	A/Y	6.0	27.35	0.03	0.05	0.0	0.13
KIWI-YOUNG	A/R						
	A-R						
	A/Y	3.0	388.68	0.02	0.01	0.01	0.04
KOHLRABI	A/R						
	A-R						
	A/Y	1.0	19.0	0.06		0.06	0.06
LAVENDER	A/R						
	A-R						
	A/Y	1.0	2.0	0.0		0.0	0.0
MILLET - GRAIN	A/R						
	A-R						
	A/Y	1.0	68.6	0.04		0.04	0.04
MINT	A/R						
	A-R						
	A/Y	1.0	35.0	6.46		6.46	6.46
MISC FRUIT TREE	A/R						
	A-R						
	A/Y	143.0	2545.67	0.02	0.09	0.0	1.0
MISC NUT TREE	A/R						
	A-R						
	A/Y	6.0	108.0	0.04	0.03	0.0	0.07

Crop	Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max
MISC ROW CROP	A/R						
	A-R						
	A/Y	36.0	2709.41	0.14	0.29	0.0	1.0
MISC VEGETABLE	A/R						
	A-R						
	A/Y	74.0	1198.34	0.01	0.04	0.0	0.3
OAT - NR	A/R						
	A-R						
	A/Y	4.0	125.0	0.0	0.0	0.0	0.0
OAT - SILAGE	A/R						
	A-R						
	A/Y	1.0	12.0	0.0		0.0	0.0
OKRA	A/R						
	A-R						
	A/Y	1.0	13.0	0.07		0.07	0.07
OLIVE-YOUNG	A/R	4.0	213.6	3.46	2.84	1.27	7.48
	A-R	4.0	213.6	19.8	13.47	8.44	35.3
	A/Y	4.0	213.6	0.01	0.01	0.0	0.02
ONION	A/R	5.0	163.1	6.59	10.71	1.66	25.74
	A-R	5.0	163.1	91.81	44.9	59.38	170.6
	A/Y	5.0	163.1	0.01	0.02	0.0	0.05
PEA	A/R						
	A-R						
	A/Y	1.0	18.0	0.0		0.0	0.0
PEACH/NECTARINE-YOUNG	A/R	13.0	231.06	10.46	16.35	0.92	61.46
	A-R	13.0	231.06	81.28	81.49	-2.94	266.1
	A/Y	13.0	231.06	0.01	0.02	0.0	0.07
PEAR-YOUNG	A/R	5.0	154.0	8.38	12.23	1.43	30.04
	A-R	5.0	154.0	57.2	43.63	12.28	124.2
	A/Y	5.0	154.0	0.01	0.01	0.0	0.02
PECAN-YOUNG	A/R						
	A-R						
	A/Y	5.0	103.79	1.24	1.48	0.1	2.86
POMEGRANATE	A/R	2.0	24.0	0.0	0.0	0.0	0.0
	A-R	2.0	24.0	-14.26	13.44	-23.76	-4.75
	A/Y	2.0	24.0	0.0	0.0	0.0	0.0

Crop	Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max
RADISH	A/R						
	A-R						
	A/Y	1.0	10.0	0.01		0.01	0.01
RYEGRASS - SILAGE/HAYLAGE	A/R						
	A-R						
	A/Y	3.0	65.6	0.0	0.0	0.0	0.0
SORGHUM/MILO - GREENCHOP	A/R						
	A-R						
	A/Y	5.0	62.17	0.0	0.0	0.0	0.0
SORGHUM/MILO - HAY	A/R						
	A-R						
	A/Y	2.0	72.0	0.01	0.02	0.0	0.02
SORGHUM/MILO - SILAGE	A/R	2.0	55.4	7.27	0.0	7.27	7.27
	A-R	2.0	55.4	137.98	0.0	137.98	137.98
	A/Y	2.0	55.4	0.03	0.0	0.03	0.03
SQUASH	A/R	6.0	60.47	2.79	2.24	0.14	5.11
	A-R	6.0	60.47	20.7	36.91	-25.11	60.32
	A/Y	6.0	60.47	0.01	0.0	0.0	0.01
STRAWBERRY	A/R						
	A-R						
	A/Y	12.0	136.1	0.02	0.03	0.0	0.12
SUDAN GRASS - GREENCHOP	A/R						
	A-R						
	A/Y	5.0	118.4	0.01	0.0	0.0	0.01
SUDAN GRASS - SILAGE	A/R						
	A-R						
	A/Y	6.0	211.2	0.0	0.0	0.0	0.01
TIMOTHYGRASS - HAY	A/R						
	A-R						
	A/Y	8.0	453.7	0.02	0.0	0.01	0.02
TRITICALE - HAY	A/R						
	A-R						
	A/Y	14.0	522.2	0.01	0.01	0.0	0.03
TRITICALE - SILAGE/HAYLAGE	A/R	1.0	42.0	0.77		0.77	0.77
	A-R	1.0	42.0	-15.02		-15.02	-15.02
	A/Y	1.0	42.0	0.0		0.0	0.0

Crop	Parameter	# Fields	Acreage	Mean	St. Dev.	Min	Max
TRUFFLE	A/R						
	A-R						
	A/Y	1.0	6.5	0.0		0.0	0.0
TURF	A/R						
	A-R						
	A/Y	7.0	563.13	25.71	14.79	0.0	38.04
VETCH	A/R						
	A-R						
	A/Y	25.0	1094.4	0.0	0.0	0.0	0.0
WATERMELON	A/R	15.0	475.97	2.89	1.54	1.23	4.8
	A-R	15.0	475.97	58.31	44.26	11.35	144.4
	A/Y	15.0	475.97	0.0	0.0	0.0	0.0
WHEAT - SILAGE	A/R	3.0	153.0	1.59	1.65	0.64	3.49
	A-R	3.0	153.0	-9.17	75.92	-53.0	78.5
	A/Y	3.0	153.0	0.01	0.01	0.0	0.02
WINTER GRAIN	A/R						
	A-R						
	A/Y	4.0	69.1	0.01	0.01	0.0	0.02
WINTER VEGETABLE	A/R						
	A-R						
	A/Y	2.0	16.1	0.01	0.0	0.01	0.01

APPENDIX B

EXAMPLE INMP MEMBER FEEDBACK REPORT

Sacramento Water Quality Coalition
2021 CY Irrigation and Nitrogen Management Plan Summary Report Results

Owner ID: ABC1000 **Owner Name: John Doe**

Reporter ID: ABC1000 **Reporter Name: John Doe**

Crop: Almond

These results represent information you provided on your 2021 crop year (CY) Irrigation and Nitrogen (N) Management Plan (INMP) Summary Report comparing your N *Applied* (A) to your N *Removed* (R) to other fields of the same crop in the Sacramento Valley Water Quality Coalition.

Table 1 below shows your results for the 2021 CY and the running total for the last 3 years (2019 – 2021 CY) for pounds of N Applied (A) per acre, pounds of N Removed (R) per acre, A divided by R (A/R[1]), and A minus R (A-R). Orange highlighting indicates your fields that are outliers for A/R compared to other fields in the Coalition of the same crop. **For perennial crops, outlier status is based on 3-year A/R (2019 – 2021 CY).**

Table 2 shows the Coalition-wide 1-yr and 3-yr A/R outlier thresholds which were used to identify outliers and the Coalition averages for A, A/R, and A-R.

3-Year A/R Status Color Key for Your Results

Outlier[2] | High (>75% of fields) | Average or Low (<75% of fields) | Not Enough Data | N/A (not applicable)

Table 1. Your Individual Field Results for 2021 CY and 3-year (2019 – 2021 CY) periods.

2021 CY - Your Fields								3-yr (2019 – 2021 CY) - Your Fields			
APN	Field Name	Irrigated Acres	Age (yrs)	Yield (lb/ac)	N Applied (lb/ac)	A/R	A-R	3-yr Total N Applied (lb/ac)	3-yr A/R	3-yr A-R	3-yr Outlier for A/R
000-000-000-001	Limit to 15 digits	77	10	9,000	290	2.69	182	600	2.5	50	yes
000-000-000-000		80	7	8,000	250	2.50	150	550	2.3	70	no
000-000-000-002		60	15	10,000	148	1.23	28	900	2.0	60	no
000-000-000-003		40	2	12,000	130	N/A	N/A	N/A	N/A	N/A	no

Table 2. Coalition Results for 2021 CY and 3-year (2019 – 2021 CY) periods for fields of the same crop.

Coalition Results	2021 CY - Coalition	3-yr (2019 – 2021 CY) - Coalition
Median Total N Applied (lb/ac)	222	700
Median A/R	1.53	1.40
A/R Outlier Threshold	N/A	**2.23**
Median A-R	77.6	60.5
No. Fields	454	300
No. Outlier Fields	N/A	20

The 3-yr A/R status color shows how your fields compare to others of the same crop across the Coalition. For perennial crops, if your 3-yr A/R value is greater than the outlier threshold for the Coalition, it is a 3-yr "outlier". For perennial crops, outlier determination is based on the 3-year A/R (2019 – 2021 CY) outlier threshold. If your value is less than this threshold but greater than 75% of all fields in the Coalition of the same crop, it is considered high. If your value is less than 75% of all fields in the Coalition for your crop, then it is average or low. In some cases, there were not enough data points to calculate outliers. N/A means the value was not calculated either because there was no N removal coefficient for the crop, the crop was a young orchard, or the field was not eligible for multi-year ratios. To be eligible for the 3-yr A/R, the field must have a perennial crop of the same type for the 2019, 2020, and 2021 CY, and the member, parcel, and field name must also be the same during this period.

Members with 3-yr A/R outliers for perennial crops ("yes" in Table 1) must have their INMP certified by an irrigation and N management plan specialist unless the Member receives additional self-certification training provided by the Coalition.

Notes:

1. A/R Value: The purpose of this value is to estimate the amount of residual N available to leach to groundwater. The A/R value (total Applied N divided by N Removed), was calculated using published N removal values from: *Nitrogen concentrations in harvested plant parts - A literature overview* (Geisseler, 2016; Geisseler, 2021). This publication documents the best available information, but values are expected to be updated and modified as new information becomes available. For many crops, the publication indicates only a few if any values could be found, while for others extensive datasets were available.
2. Outlier fields have an A/R value that is greater than the outlier threshold. The outlier threshold is generally the 75th percentile plus 1.5 x the distance between the 25th and 75th percentiles. This distance is called the interquartile range and is used to measure how spread out the results are. Some modifications to the calculation are made if the data distribution for a crop is skewed following the procedure of Hubert and Vandervieren (2008).

Sacramento Water Quality Coalition
2021 CY Irrigation and Nitrogen Management Plan Summary Report Results

Owner ID: ABC1000 **Owner Name: John Doe**

Reporter ID: ABC1000 **Reporter Name: John Doe**

Crop: Tomato - Processing

These results represent information you provided on your 2021 crop year (CY) Irrigation and Nitrogen (N) Management Plan (INMP) Summary Report comparing your N *Applied* (A) to your N *Removed* (R) to other fields of the same crop in the Sacramento Valley Water Quality Coalition.

Table 1 below shows your results for the 2021 CY for pounds of N Applied (A) per acre, pounds of N Removed (R) per acre, A divided by R (A/R[1]), and A minus R (A-R). Orange highlighting indicates your fields that are single-year outliers for A/R compared to other fields in the Coalition of the same crop for the 2021 CY. **For annual crops, multi-year outliers are any fields that were single-year outliers in 2021 and either 2020 or 2019.** Very few of the annual crop fields in the Coalition have the same crop three years in a row, preventing the use of 3-year average ratios for outlier determination.

Table 2 shows the Coalition-wide 2021 CY A/R outlier threshold and the Coalition averages for A, A/R, and A-R.

Single-Year A/R Status Color Key for Your Results

Outlier for 2021 CY[2] | High (>75% of fields) | Average or Low (<75% of fields) | Not Enough Data | N/A (not applicable)

Table 1. Your Individual Field Results for 2021 CY and 3-year (2019 – 2021 CY) periods.

2021 CY - Your Fields								2019 – 2021 CY - Your Fields	
APN	Field Name	Irrigated Acres	Age (yrs)	Yield (lb/ac)	N Applied (lb/ac)	A/R	A-R	Outlier Years for A/R	Multi-Year Outlier
000-000-000-001	Limit to 15 digits	77	10	9,000	290	2.69	182	19, 20, 21	yes
000-000-000-000		80	7	8,000	250	2.50	150	21	no
000-000-000-002		60	15	10,000	148	1.23	28	none	no
000-000-000-003		40	2	12,000	130	N/A	N/A	none	no

Table 2. Coalition Results for 2021 CY for fields of the same crop.

Coalition Results	2021 CY - Coalition
Median N Applied (lb/ac)	222
Median A/R	1.53
A/R Outlier Threshold	**2.23**
Median A-R	77.6
No. Fields	454
No. Outlier Fields	50

The single-year A/R status color shows how your annual crop fields compare to others of the same crop across the whole Coalition for the 2021 CY. If your single-year A/R value is greater than the outlier threshold for the Coalition, it is an outlier for the 2021 CY. If your value is less than this threshold but greater than 75% of all fields in the Coalition of the same crop, it is considered high. If your value is less than 75% of all fields in the Coalition for your crop, then it is average or low. In some cases, there were not enough data points to calculate outliers. N/A means the value was not calculated either because there was no N removal coefficient for the crop or the crop was a young orchard. For annual crops, multi-year outliers are any fields that were single-year outliers in 2021 and either 2020 or 2019. Very few of the annual crop fields in the Coalition have the same crop three years in a row, preventing the use of 3-year average ratios for outlier determination.

Members with multi-year A/R outliers for annual crops ("yes" in Table 1) must have their INMP certified by an irrigation and N management plan specialist unless the Member receives additional self-certification training provided by the Coalition.

Notes:

1. A/R Value: The purpose of this value is to estimate the amount of residual N available to leach to groundwater. The A/R value (total Applied N divided by N Removed), was calculated using published N removal values from: *Nitrogen concentrations in harvested plant parts - A literature overview* (Geisseler, 2016; Geisseler, 2021). This publication documents the best available information, but values are expected to be updated and modified as new information becomes available. For many crops, the publication indicates only a few if any values could be found, while for others extensive datasets were available.
2. Outlier fields have an A/R value that is greater than the outlier threshold. The outlier threshold is generally the 75th percentile plus 1.5 x the distance between the 25th and 75th percentiles. This distance is called the interquartile range and is used to measure how spread out the results are. Some modifications to the calculation are made if the data distribution for a crop is skewed following the procedure of Hubert and Vandervieren (2008).

APPENDIX C

INMP STATISTICAL GROUPINGS AND EXCLUSION THRESHOLDS BY CROP

Specific Crop	Statistical Crop Grouping	Maximum Yield (lbs/ac)	Minimum Yield (lbs/ac)	R Conversion Factor (lbs N/lbs yield)	Crop Exempt from INMP Reporting
ALFALFA - HAY	ALFALFA - HAY	35,000	1,000	0.03115	
ALFALFA - SILAGE/HAYLAGE	ALFALFA - SILAGE/HAYLAGE	50,000		0.012	
ALFALFA - GREENCHOP	ALFALFA - GREENCHOP	50,000			
ALMOND	ALMOND	10,000	100	0.068	
APPLE	APPLE	70,000	500	0.00054	
APRICOT/APRIUM	APRICOT/APRIUM	70,000	500	0.00278	
AQUACULTURE	AQUACULTURE				Y
ASPARAGUS	ASPARAGUS	10,000	200	0.002925	
BARLEY - FODDER/SILAGE	BARLEY - FODDER/SILAGE	50,000	500		
BARLEY - GRAIN	BARLEY - GRAIN	20,000	500	0.0168	
BARLEY - GREENCHOP	BARLEY - GREENCHOP	50,000	500		
BARLEY - SILAGE	BARLEY - SILAGE	50,000	500		
BARLEY - HAY	BARLEY - HAY	50,000	500		
BEAN - GREEN	BEAN - GREEN	50,000		0.00289	
BEAN - LIMA	BEAN DRY	10,000	100	0.03615	
BEAN - GARBANZO	BEAN DRY	10,000	100	0.0336	
BEAN - BLACKEYE	BEAN DRY	10,000	100	0.0365	
BEAN DRY	BEAN DRY	10,000	100	0.035416667	
BEET	BEET	75,000			
BERRY	BERRY	50,000			
BLACKBERRY	BERRY	50,000			
BLUEBERRY	BERRY	50,000			
BROCCOLI	BROCCOLI	50,000		0.0056	
BROCCOLI - SEED	SEED CROP	3,000			
CABBAGE - SEED	SEED CROP	3,000			
CABBAGE	CABBAGE	50,000			
CANOLA	CANOLA	10,000			
CARROT	CARROT	100,000		0.0014	
CHERRY	CHERRY	30,000	300	0.00221	
CHESTNUT	CHESTNUT	30,000			
CHRISTMAS TREE	CHRISTMAS TREE				
CILANTRO	CILANTRO	50,000			
CITRUS	CITRUS	70,000	300	0.00138	
CORN - FODDER/SILAGE	CORN - FODDER/SILAGE	100,000	500	0.003765	
CORN - GRAIN	CORN - GRAIN	20,000	500	0.012	
CORN - POPCORN	CORN - POPCORN	20,000			
CORN - SWEET	CORN - SWEET	50,000	300	0.003585	
COTTON	COTTON	10,000	500	0.062	
COVER CROP	COVER CROP				
CUCUMBER	CUCUMBER	120,000		0.00108	
CUCUMBER - SEED	VINE SEED	3,000			

Note:
Yield thresholds estimated from a variety of sources including CDFA production statistics, UCCE cost studies and literature, and previous years INMP data

Specific Crop	Statistical Crop Grouping	Maximum Yield (lbs/ac)	Minimum Yield (lbs/ac)	R Conversion Factor (lbs N/lbs yield)	Crop Exempt from INMP Reporting
DICHONDRA	DICHONDRA				
EGGPLANT	EGGPLANT	50,000			
FESCUE	HAY/FORAGE	50,000	100	0.0254	
FIG	FIG	50,000	100	0.00127	
FILBERT/HAZELNUT	FILBERT/HAZELNUT	10,000			
FLOWER/ORNAMENTAL	FLOWER/ORNAMENTAL				
FORAGE/HAY	HAY/FORAGE	50,000		0.0267	
GARLIC	GARLIC	50,000		0.00755	
GRAIN HAY	GRAIN HAY	50,000		0.01085	
GRAPE - OTHER	GRAPE - OTHER				
GRAPE - TABLE	GRAPE - TABLE	70,000	100	0.00113	
GRAPE - WINE	GRAPE - WINE	40,000	100	0.0018	
GRASS HAY	HAY/FORAGE	50,000	100	0.0267	
GREENHOUSE	GREENHOUSE				
HAY/FORAGE	HAY/FORAGE	50,000	100	0.0267	
HEMP	HEMP				
HERB/SPICE	HERB/SPICE				
HOPS	HOPS				
KALE	KALE	50,000			
KALE - SEED	SEED CROP	3,000			
KIWI	KIWI	50,000			
KOHLRABI	KOHLRABI	50,000			
LAVENDER	LAVENDER				
LEEK	LEEK	75,000			
LETTUCE	LETTUCE	50,000			
MANDARIN	CITRUS	70,000	300	0.00148	
MELON	MELON	100,000		0.001535	
MELON - SEED	VINE SEED	3,000			
MELON - HONEYDEW	MELON	100,000		0.001475	
MELON - CANTALOUPE	MELON	100,000		0.002435	
MILLET - GREENCHOP	MILLET - GREENCHOP	50,000			
MILLET - SILAGE	MILLET - SILAGE	50,000			
MILLET - HAY	MILLET - HAY	50,000			
MILLET - GRAIN	MILLET - GRAIN	50,000			
MINT	MINT				
MISC FIELD CROPS	MISC FIELD CROPS	100,000			
MISC FRUIT TREE	MISC FRUIT TREE	75,000			
MISC NUT TREE	MISC NUT TREE	50,000			
MISC ROW CROP	MISC ROW CROP	100,000			
MISC VEGETABLE	MISC VEGETABLE	100,000			
MULBERRY	MISC FRUIT TREE	100,000			

Note:
Yield thresholds estimated from a variety of sources including CDFA production statistics, UCCE cost studies and literature, and previous years INMP data

Specific Crop	Statistical Crop Grouping	Maximum Yield (lbs/ac)	Minimum Yield (lbs/ac)	R Conversion Factor (lbs N/lbs yield)	Crop Exempt from INMP Reporting
NECTARINE	PEACH/NECTARINE	75,000	1,000	0.00113	
NON-IRRIGATED CROP	NON-IRRIGATED CROP				Y
NURSERY	NURSERY				
OAT - GRAIN	OAT - GRAIN	20,000	500	0.01885	
OAT - FODDER/SILAGE	OAT - FODDER/SILAGE	50,000	500	0.01085	
OAT - GREENCHOP	OAT - GREENCHOP	50,000	500		
OAT - SILAGE	OAT - SILAGE	50,000	500		
OAT - HAY	OAT - HAY	50,000	500	0.01085	
OKRA	OKRA	50,000			
OLIVE	OLIVE	50,000	300	0.00314	
OLIVE - OIL	OLIVE	50,000	300	0.00314	
OLIVE - TABLE	OLIVE	50,000	300	0.00314	
ONION	ONION	75,000		0.00197	
ONION - SEED	SEED CROP	3,000			
ORANGE	CITRUS	70,000	300	0.00148	
ORCHARD GRASS - HAY	ORCHARD GRASS - HAY	50,000		0.02725	
PASTURE	PASTURE	75,000			Y, if total_n_applied=0
PEA	PEA	50,000			
PEA - FRESH	PEA	50,000			
PEA - FIELD	BEAN DRY	10,000	100	0.035416667	
PEACH/NECTARINE	PEACH/NECTARINE	75,000	1,000	0.00113	
PEAR	PEAR	75,000	1,000	0.000645	
PECAN	PECAN	10,000			
PEPPER	PEPPER	75,000		0.001655	
PERSIMMON	PERSIMMON	50,000			
PISTACHIO	PISTACHIO	10,000	100	0.02805	
PLUM	PLUM/PLUOT	75,000	300	0.001135	
PLUM/PLUOT	PLUM/PLUOT	75,000	300	0.001135	
POMEGRANATE	POMEGRANATE	75,000	300	0.00198	
POTATO	POTATO	75,000	1,000	0.00312	
PRUNE	PRUNE	20,000	300	0.0056	
PUMPKIN - SEED	VINE SEED	3,000			
PUMPKIN	PUMPKIN	75,000		0.00368	
RADISH - SEED	SEED CROP	3,000			
RADISH	RADISH	50,000			
RANGELAND	RANGELAND				
RASPBERRY	BERRY	50,000			
RICE	RICE	10,000			Y
RICE - WILD	RICE - WILD	10,000			
RYEGRASS - GREENCHOP	RYEGRASS - GREENCHOP	50,000	500		
RYEGRASS - SILAGE/HAYLAGE	RYEGRASS - SILAGE/HAYLAGE	50,000	500		

Note:
Yield thresholds estimated from a variety of sources including CDFA production statistics, UCCE cost studies and literature, and previous years INMP data

Specific Crop	Statistical Crop Grouping	Maximum Yield (lbs/ac)	Minimum Yield (lbs/ac)	R Conversion Factor (lbs N/lbs yield)	Crop Exempt from INMP Reporting
RYEGRASS - HAY	RYEGRASS - HAY	50,000	500	0.02745	
SAFFLOWER	SAFFLOWER	10,000	300	0.02585	
SEED CROP	SEED CROP	5,000			
SORGHUM/MILO - GREENCHOP	SORGHUM/MILO - GREENCHOP	75,000	500		
SORGHUM/MILO - SILAGE	SORGHUM/MILO - SILAGE	75,000	500	0.00367	
SORGHUM/MILO - HAY	SORGHUM/MILO - HAY	75,000	500		
SORGHUM/MILO - GRAIN	SORGHUM/MILO - GRAIN	20,000	500	0.0165	
SQUASH	SQUASH	75,000		0.001835	
SQUASH - SEED	VINE SEED	3,000			
STRAWBERRY	STRAWBERRY	90,000			
SUDAN GRASS - SEED	SEED CROP	3,000			
SUDAN GRASS - GREENCHOP	SUDAN GRASS - GREENCHOP	50,000			
SUDAN GRASS - SILAGE	SUDAN GRASS - SILAGE	50,000			
SUDAN GRASS - HAY	SUDAN GRASS - HAY	50,000			
SUNFLOWER	SUNFLOWER	10,000	100	0.0316	
TIMOTHYGRASS - HAY	TIMOTHYGRASS - HAY	50,000			
TOMATILLO	TOMATILLO	50,000	1,000		
TOMATO - FRESH MARKET	TOMATO - FRESH MARKET	200,000	3,000	0.001305	
TOMATO - PROCESSING	TOMATO - PROCESSING	200,000	3,000	0.00146	
TRITICALE - GRAIN	TRITICALE - GRAIN	50,000	500	0.0202	
TRITICALE - GREENCHOP	TRITICALE - GREENCHOP	50,000	500		
TRITICALE - SILAGE/HAYLAGE	TRITICALE - SILAGE/HAYLAGE	50,000	500	0.004515	
TRITICALE - HAY	TRITICALE - HAY	50,000	500		
TURNIP	TURNIP	70,000			
TURNIP - SEED	SEED CROP	3,000			
VEGETABLE SEED	SEED CROP	3,000			
VETCH	VETCH	20,000			
VINE SEED	VINE SEED	3,000			
WALNUT	WALNUT	15,000	300	0.0159	

Note:
Yield thresholds estimated from a variety of sources including CDFA production statistics, UCCE cost studies and literature, and previous years INMP data

ATTACHMENTS

Attachment 1: Annual Management Practice Implementation Data

Attachment 2: Annual Irrigation and Nitrogen Management Plan Summary Report Data

ATTACHMENT 1

ANNUAL MANAGEMENT PRACTICE IMPLEMENTATION DATA

Excel workbook provided electronically

ATTACHMENT 2

ANNUAL IRRIGATION AND NITROGEN MANAGEMENT PLAN SUMMARY REPORT DATA

Excel workbook provided electronically