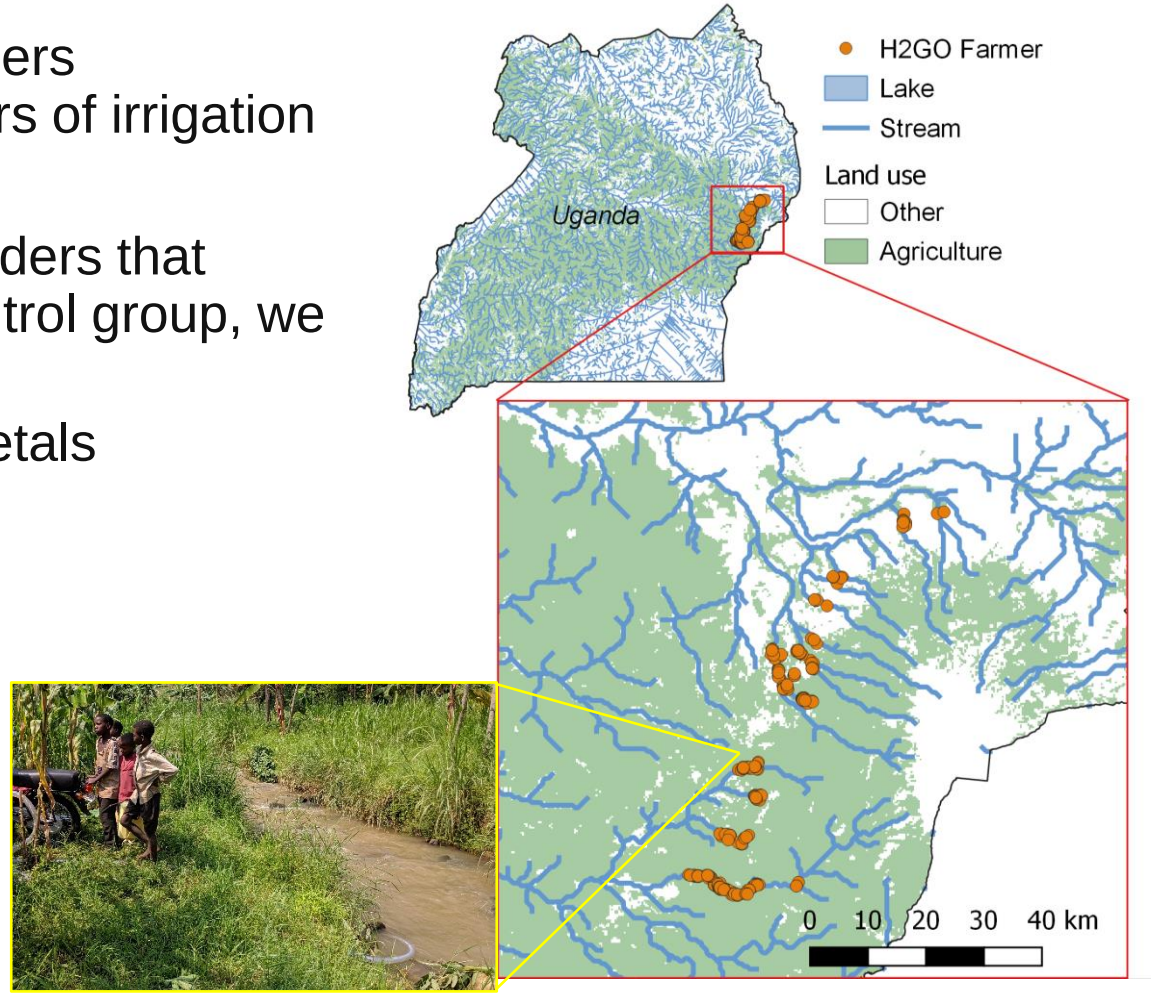
GH+ Labs

H2Go Irrigation Pump Durability Report

July 2020

Executive Summary: No impact to motorcycle with use of H2GO pump technology

- Over the course of a three-month dry-season, 175 farmers participated in irrigation services for a total of 1500 hours of irrigation provided.
- After analyzing motorcycle conditions from a group of riders that actively provided irrigations services (H2Go) and a Control group, we found:
  - No difference in the accumulation of engine wear metals
  - No difference in engine oil degradation rates
  - No difference in necessary service frequency



Implementing Field Durability Program to Assess Engine Wear Concern

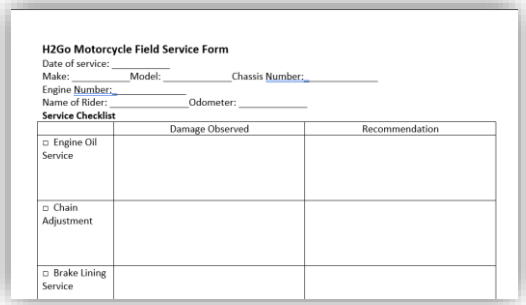
Field durability program for Boda riders

- Participants: 20 H2Go* riders & 10 Control riders
  - All riders using Bajaj Boxer BM 100. Each rider uses same bike for duration of season**
- Duration: 12 weeks
- At a weekly interval, the following is serviced on every bike:
  - Tappets, Air Filter, Spark Plug, Carburetor
  - Oil changed and collected
    - Brand: Verma Co. SAE 20W50 API SL JASO MA16
- For each component being serviced, we record the mechanic's observations, maintenance recommendations and actual service done
- At the beginning and end of the season, each bike undergoes a comprehensive service where we additionally evaluate the state of:
  - Pistons, valves, cylinder head, crankshaft, and oil filter

Engine oil samples (collected weekly) are analyzed*^ for:

- Metal concentration: Aluminum, Lead, Iron, Chrome
- Oil Quality: Total Base Number (TBN), Viscosity, Oxidation and Nitration Products

**Conducting irrigation services*
***Estimated average bike age is 3 years. Frame numbers for each bike can be provided*
**^Collection and testing procedure detailed in appendix slide*



H2Go Motorcycle Field Service Form

Date of service: _____
Make: _____ Model: _____ Chassis Number: _____
Engine Number: _____
Name of Rider: _____ Odometer: _____

Service Checklist

	Damage Observed	Recommendation
☐ Engine Oil Service		
☐ Chain Adjustment		
☐ Brake Lining Service		

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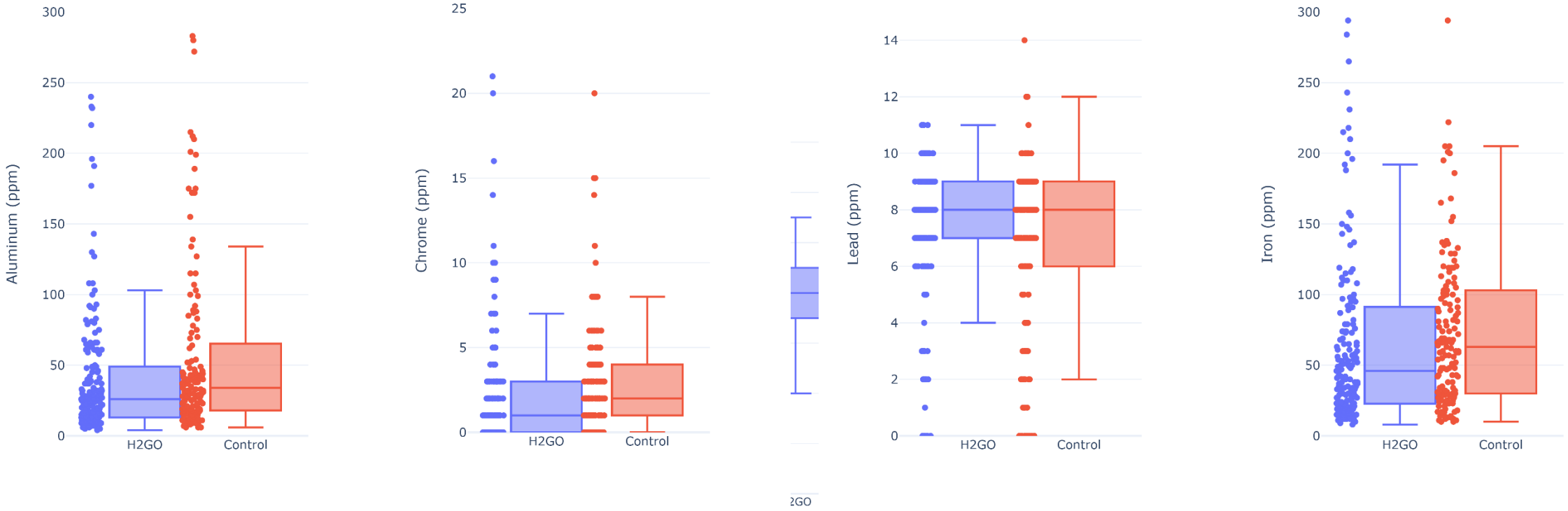
Engine wear metal concentrations are marginally lower in the H2GO pump group



Each dot represents analysis of a single sample of engine oil taken from a single rider on a weekly interval. H2Go and Control riders are seen to have a similar distribution for weekly accumulation of primary engine wear metals: aluminum, iron, lead, and chrome. Mean concentrations of wear metals from weekly samples collected thus far are greater in the Control rider population than the H2Go rider population.

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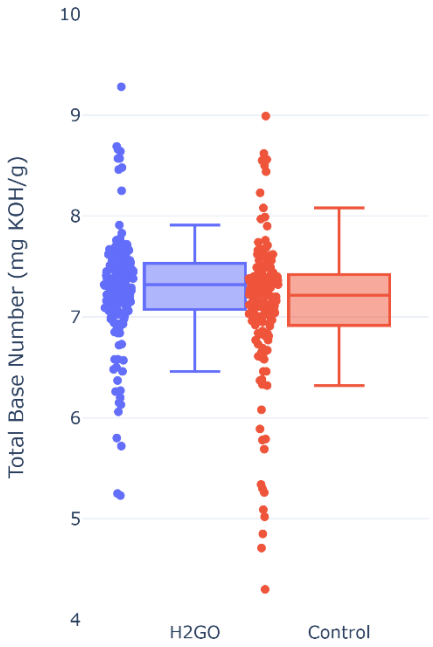
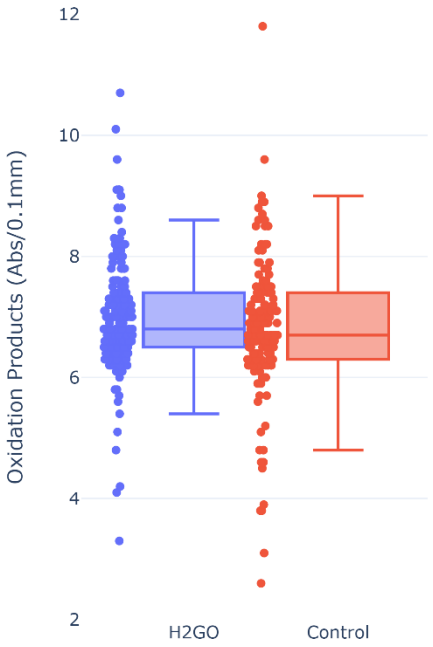
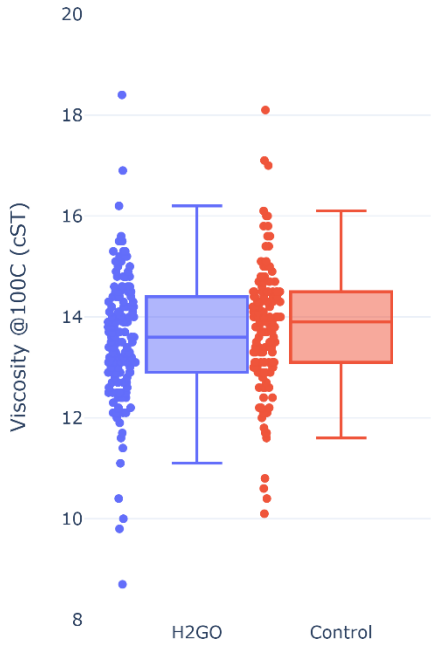
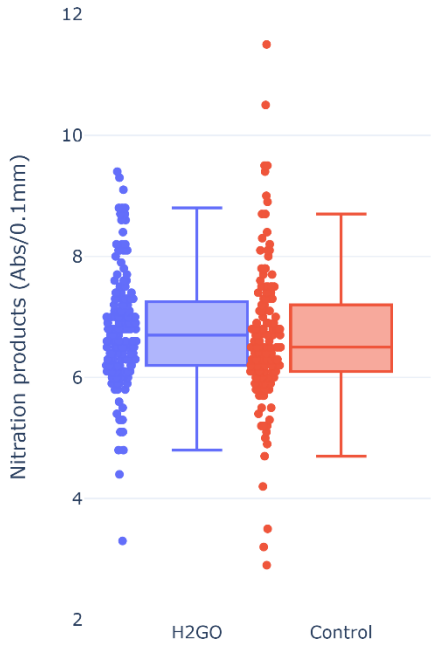
Oxidation rates and oil viscosity are similar for both groups



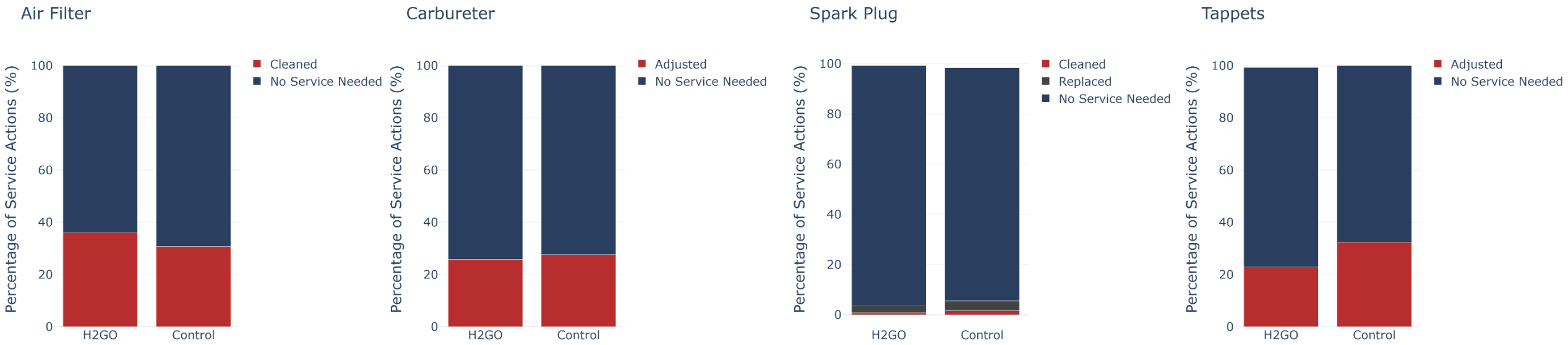






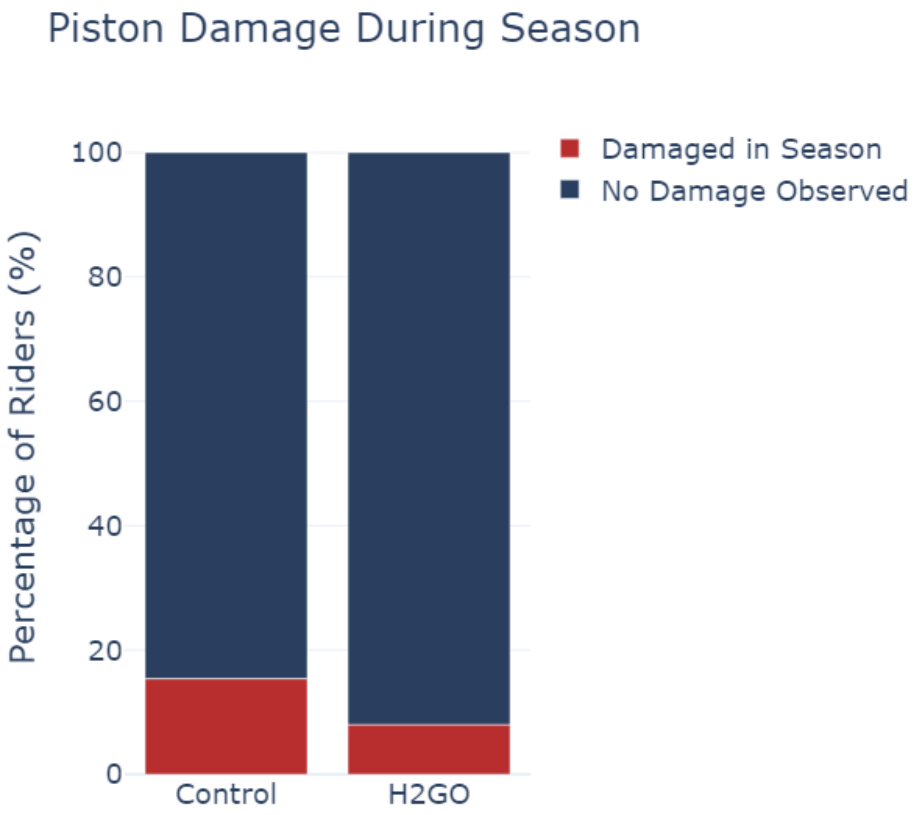
Each dot represents analysis of a single sample of engine oil taken from a single rider on a weekly interval. Excess oil oxidation would result in a reduced value of total base number (TBN) and an increase in oxidation products. H2Go and Control riders have similar sample distributions for weekly viscosity measurements and oxidation rates suggesting H2Go services do not seem to be causing an increase in engine oil oxidation with weekly engine oil change interval

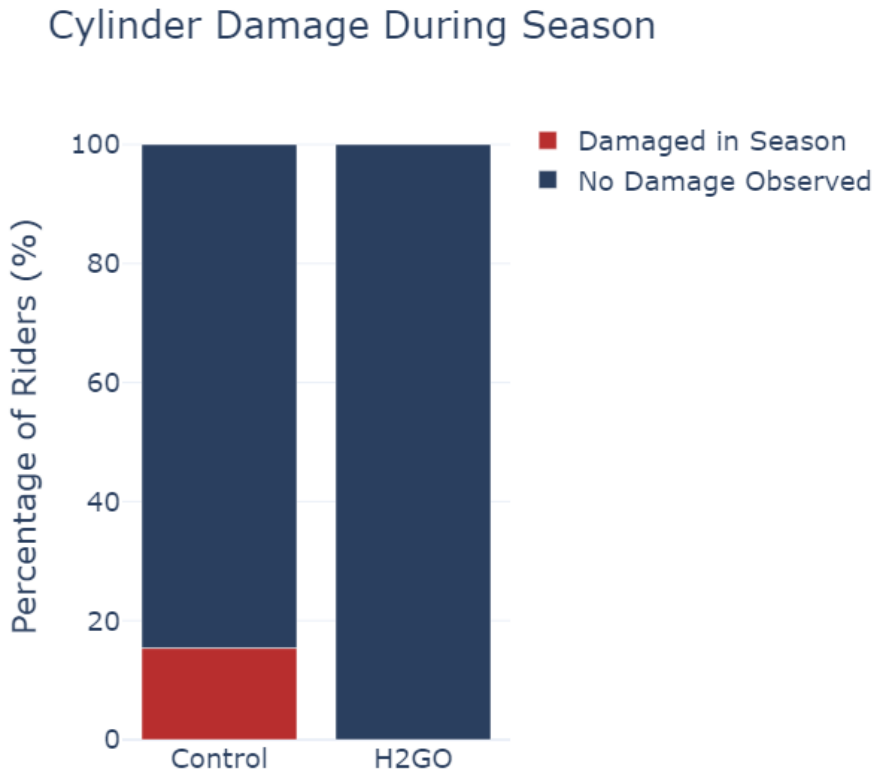
Service actions during weekly service are similar for both groups



Percentage of total services where each action (e.g.: component adjusted or no service needed) is taken for Control and H2Go riders for weekly service on carburetor, tappets, air-filter, and spark-plug. There appears to be no difference in the frequency of service needed for tappets, spark-plugs, air-filters or carburetor between H2Go and Control rider populations.

Comprehensive Service Actions Required After Full Irrigation Season

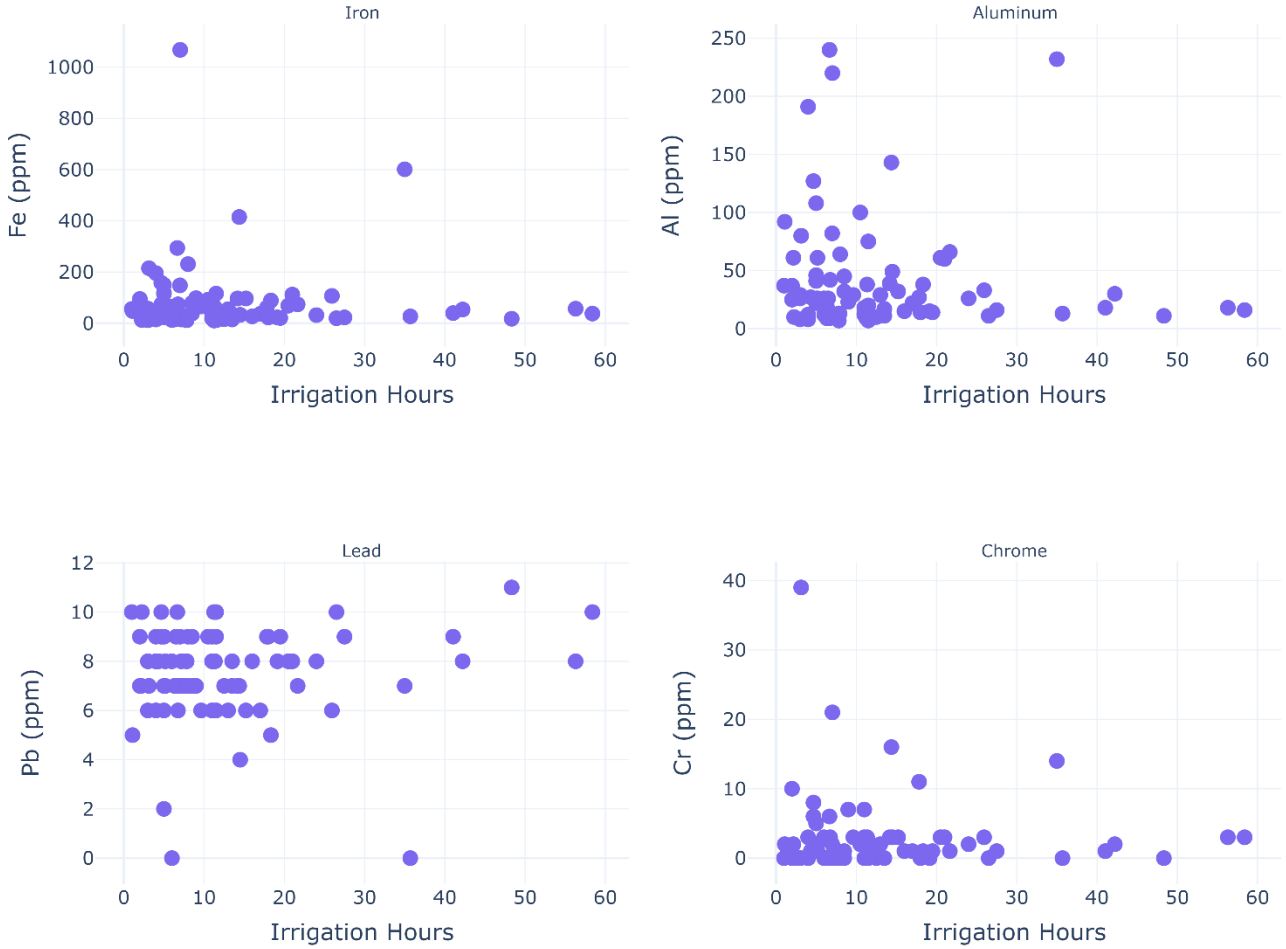




Percentage of riders that required service or replacement of the piston or cylinders after the entire three-month dry-season. The integrity of the internal engine components were only evaluated at the beginning and end of the dry-season to limit the number of times the engine block was opened. Performing irrigations (H2Go group) was not shown to increase the likelihood of damage to the internal components of the power-system. Control riders required a greater frequency of service for pistons and cylinders.

Engine wear metal is not observed to correlate with irrigation hours in a given week

- Each dot represents analysis of a single sample of engine oil taken from a single H2Go rider on a weekly interval
- Irrigation hours are the total hours that a rider irrigated in the week preceding the engine oil collection
- Riders are capable of irrigating for upwards of 50 hours in each week without significant accumulation of engine wear metals



Oxidation rates and oil viscosity are not observed to correlate with irrigation hours in a given week

- Each dot represents analysis of a single sample of engine oil taken from a single H2Go rider on a weekly interval
- Excess oil oxidation would result in a reduced value of total base number (TBN) and an increase in oxidation products
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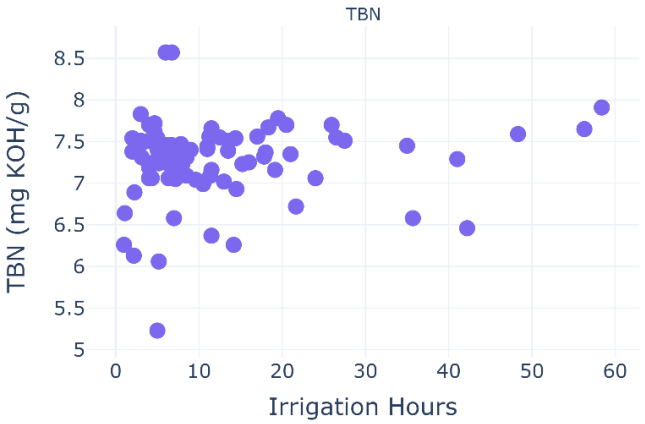
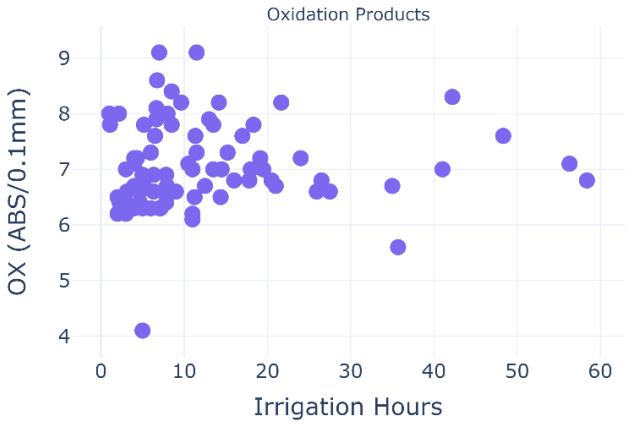
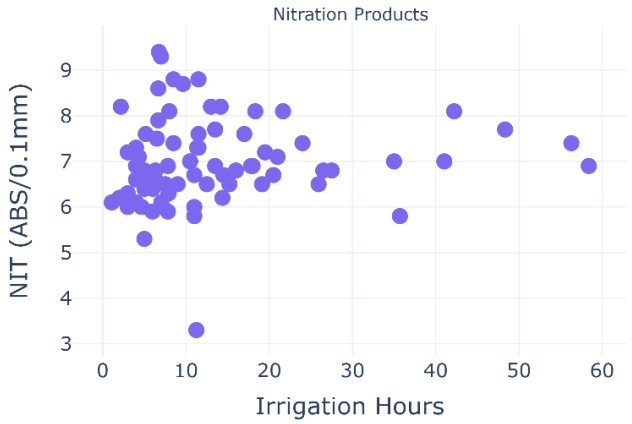
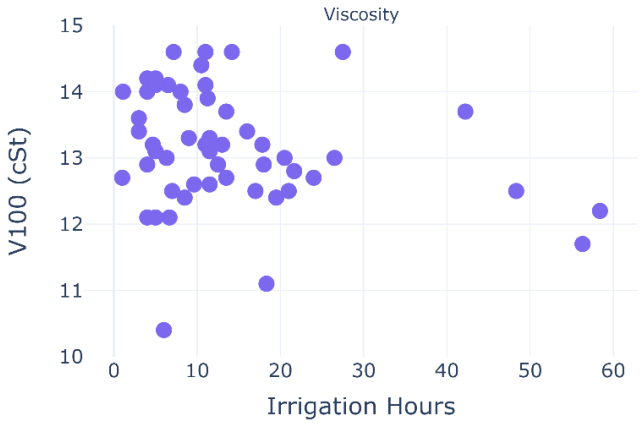


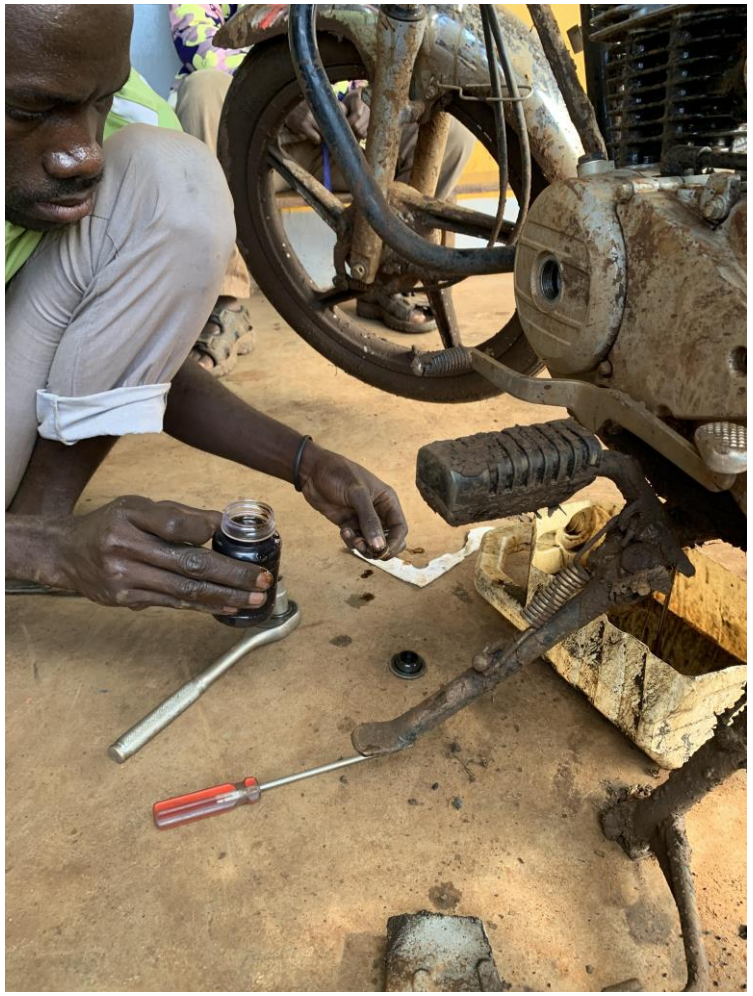






Appendix

Collection Procedure:

1. Remove oil drain plug and begin draining oil.
2. After 5 seconds of draining oil, begin capturing draining oil in one of the provided sample collection containers (**DO NOT** collect the very first oil that drains). Capture directly from the draining stream of oil. Collect oil until the sample container is full.
3. Attach lid to the sample container.
4. Each sample container has a number (1-300). Write this number on the form corresponding to this service.
5. On the sample label write: Date of Service, Name of Rider, Chassis (Frame) number
6. Store samples in provided box. Keep out of direct sunlight in cool environment until pick-up by IV Labs

- **Oil Samples analyzed by Apex Oil Lab, Grand Rapids, MI, USA**
- Wear Metals: ASTM D6595-00
- Viscosity: ASTM D445
- Oxidation: E2412