United States Department of Agriculture

Hoolehua Plant Materials Center
FY2023 Progress Report of Activities

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Plant Materials Centers (PMC) support conservation objectives set by the Natural Resources Conservation Service (NRCS). The Hoolehua Plant Materials Center (HIPMC) is one of 25 Plant Materials Centers that serve NRCS Field Offices around the country (Figure 1). The service area of each PMC is based on unique environmental conditions, and together, the PMCs cover the broad environmental ranges within the United States. PMCs select conservation plants and develop innovative planting technology to address today's natural resource challenges and help to maintain healthy and productive farms and ranches. This report is a summary of activities the HIPMC conducted from October 1, 2022, to September 30, 2023.

Figure 1. The Hoolehua Plant Materials Center occupies 80 acres in the central part of the island of Molokai, Hawaii.

Studies

Forage Grass Establishment

This study was initiated in response to Field Offices' request for rainfed pasture establishment techniques without the use of heavy tillage and planting equipment that typical ranchers in the Pacific Island Area (PIA) do not own. The un-replicated study was performed on a ranch in eastern Molokai Island, Hawaii and utilized 2 phases. Phase 1: Determine what factors (grass species, seeding rate, soil disturbance) were ideal for the particular site conditions that would contribute to successful forage establishment. Phase 2: Utilize the information from Phase 1 to demonstrate the establishment technique on a larger scale. Treatments for Phase 1 included two grass species (bahia grass [*Paspalum notatum*] and palisade grass [*Brachiaria brizantha*]), three seeding rates (15, 30, 60 seed/square foot), and soil disturbance with spike-toothed harrow vs. no disturbance. The trial was installed on March 21, 2021, and observed over five months. When asked which treatment he thought was best, the rancher favored the palisade grass at 60 seed/square foot with no soil disturbance because of its performance, the simplicity to establish and it was supported with HIPMC evaluations. Based on canopy cover observations, it was determined that the seeding rate should be reduced between 30 and 60 seeds/square foot. Phase 2 was initiated on a 1.6-acre plot on January 7, 2022, where palisade grass seed was broadcast at 45 seed/square foot. The planting failed due to abnormally low rainfall of 7.4 inches from January to May where average rainfall is typically 15.6 inches (figure 2). The plot was replanted on December 2, 2022. With rainfall of 16.5 inches during the first five months the grass grew well (figure 2). The first evaluation at 6-months after planting showed grass biomass yield of 4,966 dry lb/acre. The last evaluation will be done at 12-months after planting on December 2, 2023. Details on the implementation of this forage establishment method will be included in a final study report in fiscal year 2024.

Figure 2. The results at 5 months after planting of two attempts at establishing forage grass at large-scale using a method chosen by the cooperating rancher on eastern Molokai Island, Hawaii. The establishment in 2022 (left) failed when only 7.4 inches rainfall fell from January 7 to June 2, 2023, while the historical mean rainfall during this period was 15.4 inches. In a second attempt at establishment, forage grass seed was broadcast on December 2, 2022. With rainfall of 16.5 inches over the following five months the grass grew well (right).

Monthly Forage Potential Yield for Tropical Forages

Estimating available forage is an essential step to balancing animal production and feed requirement. To accomplish this, a simple model was adapted to estimate forage yield based on maximum forage yield of common grass species such as Guinea (*Megathyrsus maxima*), Kikuyu (*Pennisetum clandestinum*), buffel (*Cenchrus ciliaris*), signal (*Brachiaria decumbens*), and palisade (*Brachiaria brizantha*) grasses. A field trial was initiated in 2020 at the HIPMC to collect forage yield data where the five common grasses were supplied with more than adequate nutrients and water. Yield data was collected monthly for two years and ended in October 2022 (figures 3 and 4). The yield data will be inserted into the model that estimates available forage in the PIA Prescribed Grazing Tool.

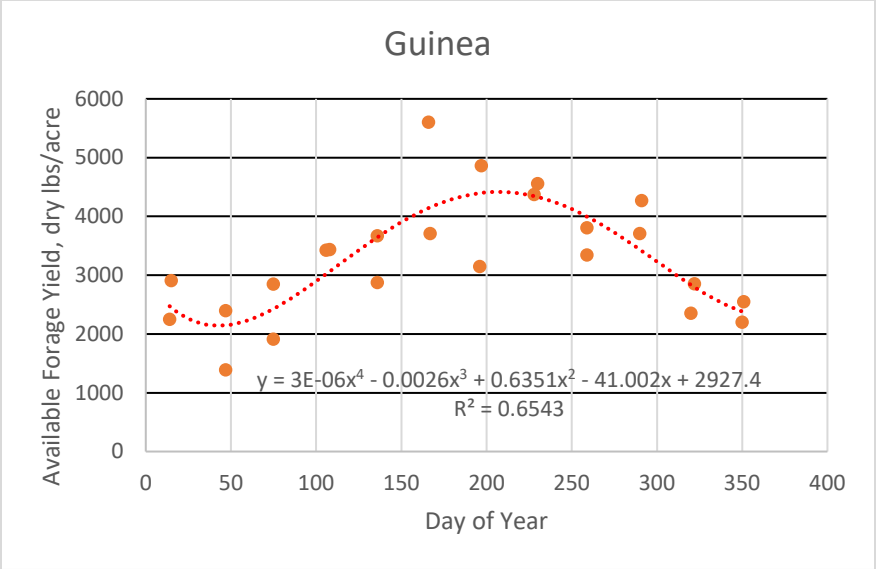

Figure 3. Monthly yield curve of guinea grass grown at the HIPMC, Hoolehua, Hawaii, and supplied with more than adequate nutrients and water.

Figure 4. John Colon (Biological Science Technician) operates a plot-harvester to collect bulk forage biomass and Richard Ogoshi (left) collects forage subsamples to measure forage yield from a buffelgrass plot at the HIPMC, Hoolehua, Hawaii.

Technical Note

A Decision Support Tool for Determining Optimal Planting Dates

In response to NRCS Field Office Planners' need for a method to identify planting dates for forage grass establishment, the HIPMC developed the Rainfall Sufficiency Tool. In the tropics, the conventional practice is to plant forage grasses at the beginning of the wet season. Whether the wet season will produce enough rain to meet the need for forage grass establishment is not readily known but can be approximated from easily obtainable information, such as historical rainfall. The Rainfall Sufficiency Tool is an Excel spreadsheet composed of a database and user display (Figure 5). The database is an assemblage of climatological data (1991-2020) from the National Climate Data Center for 110 locations in the Pacific Island Area. The Hamon equation was selected as the best estimator of potential evapotranspiration among four temperature-based equations tested in Hawaii. Crop evapotranspiration is calculated using monthly temperature and an appropriate crop coefficient. Crop evapotranspiration is considered the benchmark for sufficient rainfall. Crop evapotranspiration is plotted against monthly rainfall terciles generated from 30-year historical rainfall. The terciles separate categories below-, near-, and above-normal rainfall that have equal chances (1/3) of occurring where lead-time is greater than 6 months, providing a climatological forecast. The Rainfall Sufficiency Tool gives the planner a monthly approximation of the chances of having sufficient rain to establish forage grass and helps clients to understand the risk.

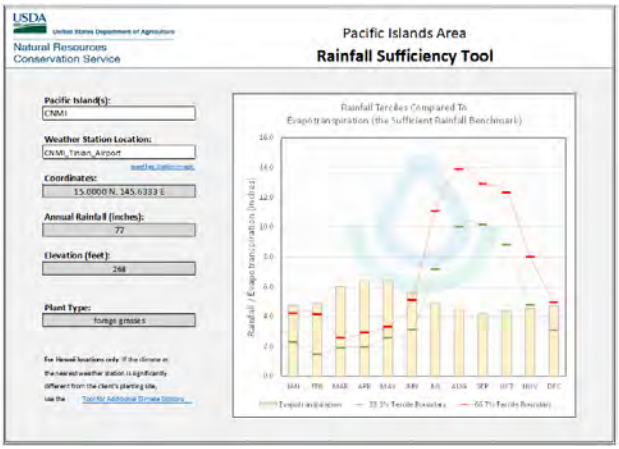

Figure 5. Chart displayed from the Rainfall Sufficiency Tool. The 33.3%Tercile and 66.7% Tercile boundaries for each month are based on historical rain data from 1991-2020. Evapotranspiration is calculated from a calibrated Hamon equation and air temperature. The extent that evapotranspiration falls below the rainfall tercile boundaries approximates the likelihood of sufficient rainfall for forage establishment in a month.

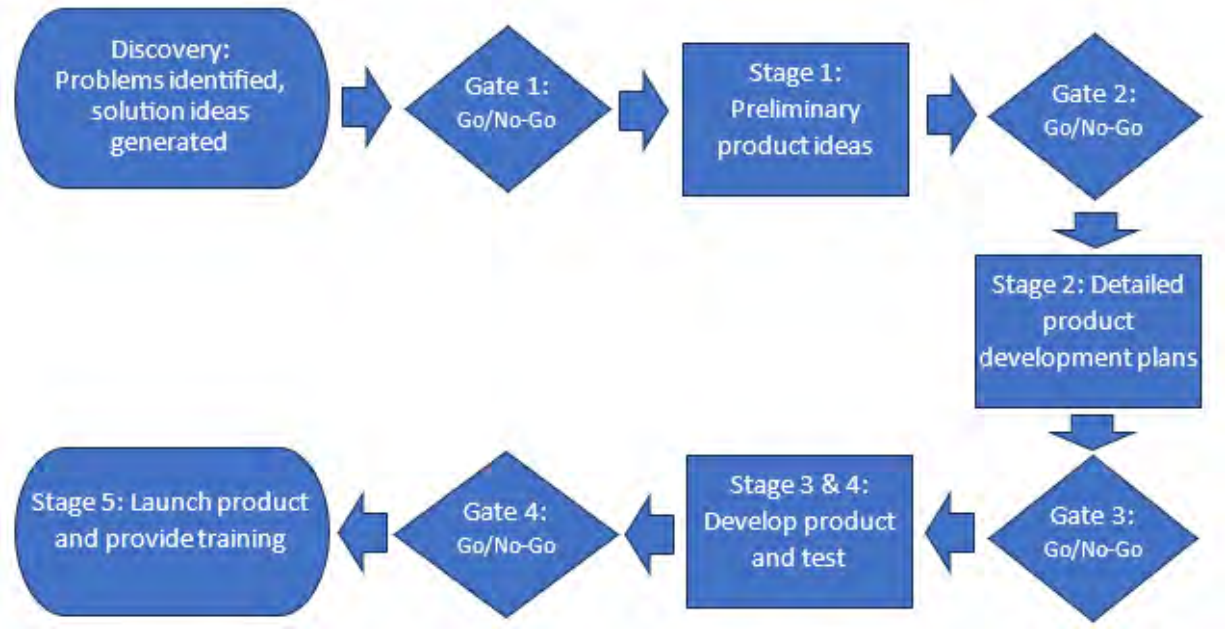

Figure 6. A product development process called Stage-Gate was initiated this year at the HIPMC to produce tools, training, and technical notes that are responsive to conservation worker needs. The diagram above describes the process where decision-makers such as field office staff and state leaders approve whether an idea or work in the preceding stage is adequate to go to the next stage.

Plant Needs Survey and Product Development Process

Studies are a fundamental method for the HIPMC to produce science-based information that benefit conservation planners. A study plan is developed based on conservation planner needs and valuable information is generated to address that need. However, the information may not have been properly packaged for conservation planners to use or the information may not have been exactly what was needed. To address the disconnect, HIPMC developed a different approach that emphasizes product development and involves conservation planners more heavily in the process. The new approach aligns with a product development process called Stage-Gate that is used by more than 80% of North American companies like 3M, General Motors, and Hewlett-Packard innovate new products. The HIPMC version of Stage-Gate begins with in-depth, in-person interviews of Field Office staff that solicit challenges they face with planning and advising conservation practices (Discovery, figure 6). PMC staff and State Specialists review the challenges that inspire solutions and decide which solutions move forward to develop preliminary solution ideas such as conservation plant-related tools, demonstrations, technical notes, or trainings (Gate 1, figure 6). Preliminary solution ideas are presented to District Conservationists and State Leaders who decide which ideas move forward to further develop (Gate 2, figure 6). The ideas that move forward are developed into a detailed product development plan that include procedures, timeline, and resources that may include a traditional study plan if new information is required. The State Leaders and Regional Specialist decide whether product development plan moves forward (Gate 3, figure 6). The products are produced by the HIPMC staff and State Specialists and tested by volunteer Field Office staff. Once the product is completed, State Leaders decide whether the product is made available to all Field Office staff (Gate 4, figure 6). HIPMC initiated work in the Discovery Stage this year and completed interviews for 9 of 10 Field Offices in the PIA and expects to reach Stage 3 & 4 in the next fiscal year (figure 6).

Technology Transfer

- PIA Plant Materials Technical Note 6: Commercial Sources for Conservation Plant Materials https://efotg.sc.egov.usda.gov/references/public/HI/PIA-PMTN_06_Commercial_Sources_for_Conservation_Plant_Materials.pdf
- PIA Plant Materials Technical Note 12: Rainfall Sufficiency Tool https://efotg.sc.egov.usda.gov/references/public/HI/PMTN_12_Rainfall_Suffiency_Tool_v1_1.pdf
- Prescribed Grazing Tool https://efotg.sc.egov.usda.gov/#/state/HI/documents/section=4&folder=-186
- Final Study Report: Warm Season Cover Crop Study https://www.nrcs.usda.gov/plantmaterials/hipmcsr13938.pdf

Who We Are

The HIPMC is one of 25 centers operated by the NRCS. The HIPMC services the PIA which includes the State of Hawaii, American Samoa, Guam, Commonwealth of Northern Mariana Islands, The Federated States of Micronesia, The Republic of Palau, and The Republic of the Marshall Islands. The HIPMC was initially established on the island of Maui in 1957 and was later relocated to the island of Molokai in 1973.

What We Do

The mission of the NRCS Plant Materials Program is to assemble and test plant species for use in conservation programs to solve natural resource concerns. The program's vision is to function as the plant experts for NRCS, fully integrated and coordinated with technical and field office staff, developing, and delivering vegetative solutions and conservation technology for NRCS customers. In working with a broad range of plant species, including grasses, forbs, trees, and shrubs, the program seeks to address priority plant needs of the NRCS field offices and land managers in both public and private sectors. Where practical, the use of native plants to solve conservation problems and to protect and restore ecosystems is emphasized.

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