Global Yield Gap Atlas

# What makes GYGA a unique data source?

## 1 GLOBAL PROTOCOL FOR HIGH QUALITY & LOCALLY RELEVANT YIELD DATA

GYGA data is collected by following a "bottom-up" global protocol to organise soil, climate, and cropping system data to ensure local relevance. The protocol implements a leveled approach for data collection, with a preference for use of primary data.

Furthermore, the use of local knowledge of local agronomists, GYGA ensures high quality and local relevance in the data it offers.

## 2 RESULTS ARE AVAILABLE AT DIFFERENT SPATIAL LEVELS

GYGA results are currently available at three spatial levels: 1) Weather stations, 2) Climate zones, 3) National.

## 3 SCIENTIFIC CREDIBILITY OVER THE YEARS

GYGA has established scientific credibility since it was founded as its methods and applications have resulted in dozens of well-cited scientific publications.

## WANT TO EXTEND GYGA'S BENEFITS TO YOUR ORGANISATION?

Learn more about GYGA license and sponsorship subscription. Our current subscribers include Yara, Bill & Melinda Gates Foundation, and a number of world's leading agro-inputs, biostimulant, and management consultancy companies.

Got questions or see scope of partnership? Contact us at **gyga.support@wur.nl.**

WAGENINGEN UNIVERSITY & RESEARCH

University of Nebraska Lincoln

**www.yield gap.org**

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**70** COUNTRIES

are current being covered in GYGA across all continents (Africa, Asia, Oceania, Americas, Europe).

AVERAGE ANNUAL WEBSITE VISITS **60,000**

**19,000** AVERAGE DATA DOWNLOADS

over the past five years

Check out www.yieldgap.org to explore how GYGA could support your decision on crop cultivation!

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GLOBAL YIELD GAP ATLAS (GYGA)

# HOW OUR USERS BENEFIT FROM GYGA

WWW.YIELDGAP.ORG

## MARKET IDENTIFICATION & INVESTMENT PRIORITISATION

"What are the areas in a country or the world where your product or investment could achieve the highest return on investment?" Use GYGA data to strengthen your market identification and prioritisation of your investment, field trials, and scaling out of your innovation.

## HIGH QUALITY AND LOCALLY-RELEVANT YIELD DATA SOURCE

GYGA uses a 'bottom up' approach , which means that it uses locally collected data by country agronomists to ensure local relevance for your decision making. The data are available at national, climate zone, and weather station levels.

## BENCHMARKING FOR CROP MODELLING

The high quality and locally-relevant yield gap, potential yield and resource use efficiency data offered by GYGA has been used as benchmarking for crop production and agri-tech innovations.

## IMPACT ASSESSMENT OF YOUR INVESTMENT IN AGRICULTURE

Measure the impact of your investment by monitoring progress of indicators such as yield gap closure or water productivity. Since 2019, an indicator called Yield Gap Closure, based on GYGA, has been included for the assessment of SDG2 by the UN-SDSN.

## YIELD GAP, FOOD SECURITY, LAND USE ANALYSIS

GYGA has been used as a starting point to understand the causes of yield gaps and to undertake research on how to close the yield gap in practice. GYGA data is also used for strategic food security and land use analyses.

Get on board on our journey towards a climate-positive food future through data-driven agronomy! Got questions or see scope for partnership? Contact us at **gyga.support@wur.nl**

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# GYGA protocol – Bottom-up approach for data collection

**STEP 1**

Crops

### Identify the target crop

a. For relatively large countries, only crops with total national harvested area of >100,000 ha are evaluated in GYGA separately for irrigated and rainfed conditions.
b. For smaller countries also crops with <100,000 ha are evaluated in GYGA.

**STEP 2**

Location

### Identify the areas in a country in which the target crop is grown, using the SPAM crop mask (You et al., 2020)

**STEP 3**

Climate zones

### Identification of key climate zones where the crop is grown

a. Climate zones are defined by growing degree days, temperature seasonality, and aridity index.
b. Within a country, identify CZs with >5% of total national harvested crop area for the crop/water regime (irrigated or rainfed) in question. These CZs are **the "designated" CZs (DCZs)** for yield gap assessment of that crop and water regime in that country.
c. **The selected DCZs typically contain more than 50% of national crop area** except in a few cases.

**STEP 4**

Weather station

### Selection of weather station points

a. Selected weather stations can either be **existing points** where a weather station exists with long-term weather data of adequate quality for yield gap assessment, or a **hypothetical** weather station location in cases where there is large crop area but without existing weather station coverage. The selected stations are called **reference weather stations (RWS)**
b. Criteria:
   i. >1% of total area within their buffer zones
   ii. Select weather stations with greatest harvested area, re-rank, and so forth **until total harvested area in buffer zones of selected weather stations reaches 50% of total national harvested crop area.**

**STEP 5**

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Data

### Collecting weather data at 'points' level

*Sources of weather data*:
   i. Preference 1: Long-term (10-20 years) observed daily weather data (Tmax, Tmin, humidity, precipitation and ideally solar radiation) from a reference weather station within buffer zone. The number of years must be in the upper range of years for locations with highly variable rainfall
   ii. Preference 2: If less than 10 years observed weather data (minimum of one complete year, preferably 3-5 years) ⊠ use these data to correct long-term NASA-POWER data and retrieve precipitation data from TRMM or NASA-POWER databases
   iii. Preference 3: NASA-POWER weather data

**STEP 6**

Soil/cropping system

### Identify soil types and cropping systems

a. Select dominant soil type(s) x cropping systems in harvested corp area within buffer zones (use expert opinion of country agronomists)
b. *Sources of soil data for rainfed crops (texture, bulk density, effective rooting depth, slope).*
   i. Select soil classes until achieving 50% crop area coverage of crop harvested area within a buffer zone
   ii. Verify with expert knowledge from GYGA country agronomists and GYGA team members
c. *Sources of cropping system (Number of crop cycles per year, sowing date, planting density, maturity date, cultivar)*
   i. Preference 1: Existing national survey data
   ii. Preference 2: GYGA country agronomists expert opinion
   iii. Preference 3: Large, relatively coarse scale datasets (e.g. Cropmonitor data from GeoGlam)

**STEP 7**

Yield

### Determine actual yields (Ya)

a. Required timeline:
   i. Irrigated crops: 5 years average
   ii. Rainfed: 10-15 years
b. *Sources of actual yields data*:
   i. Preference 1: High quality sub-national data (county, district, village, municipality level)
   ii. Preference 2: Observed yields in areas with highest crop densities e.g. surveys by CGIAR, World bank, research projects with on-farm yield data
   iii. Preference 3: Targeted survey conducted by GYGA agronomists
   iv. Preference 4: SPAM data

**STEP 8**

Simulation

### Simulation of irrigated potential yield (Yp) or rainfed potential yield (Yw)

a. Yp and/or Yw will be simulated for each cropping system x soil type x RWS (CSxSoilxRWS)
b. Estimated Yp and Yw values are upscaled from RWS to the CZ level by weighting for the proportion of harvested area for each RWS x Soil x CS combination.
c. Results at CZ level are used to upscale to the national level by weighting for the proportion of harvested area for each CZ based on SPAM crop mask.

**STEP 9**

Calculation

### Calculation of yield gap (Yg)

a. The years for which we simulated Yp or Yw and for which Ya estimations are available may not match and therefore we calculate Yg as an average value based on average Yp or Yw at each spatial scale and the associated average value of Ya.
b. If Ya is only available at a national level, Yg will be estimated by a single value of Ya and will vary only to the extent that Yp or Yw vary at different spatial scales, from the RWS, to CZ, administrative units and nation.