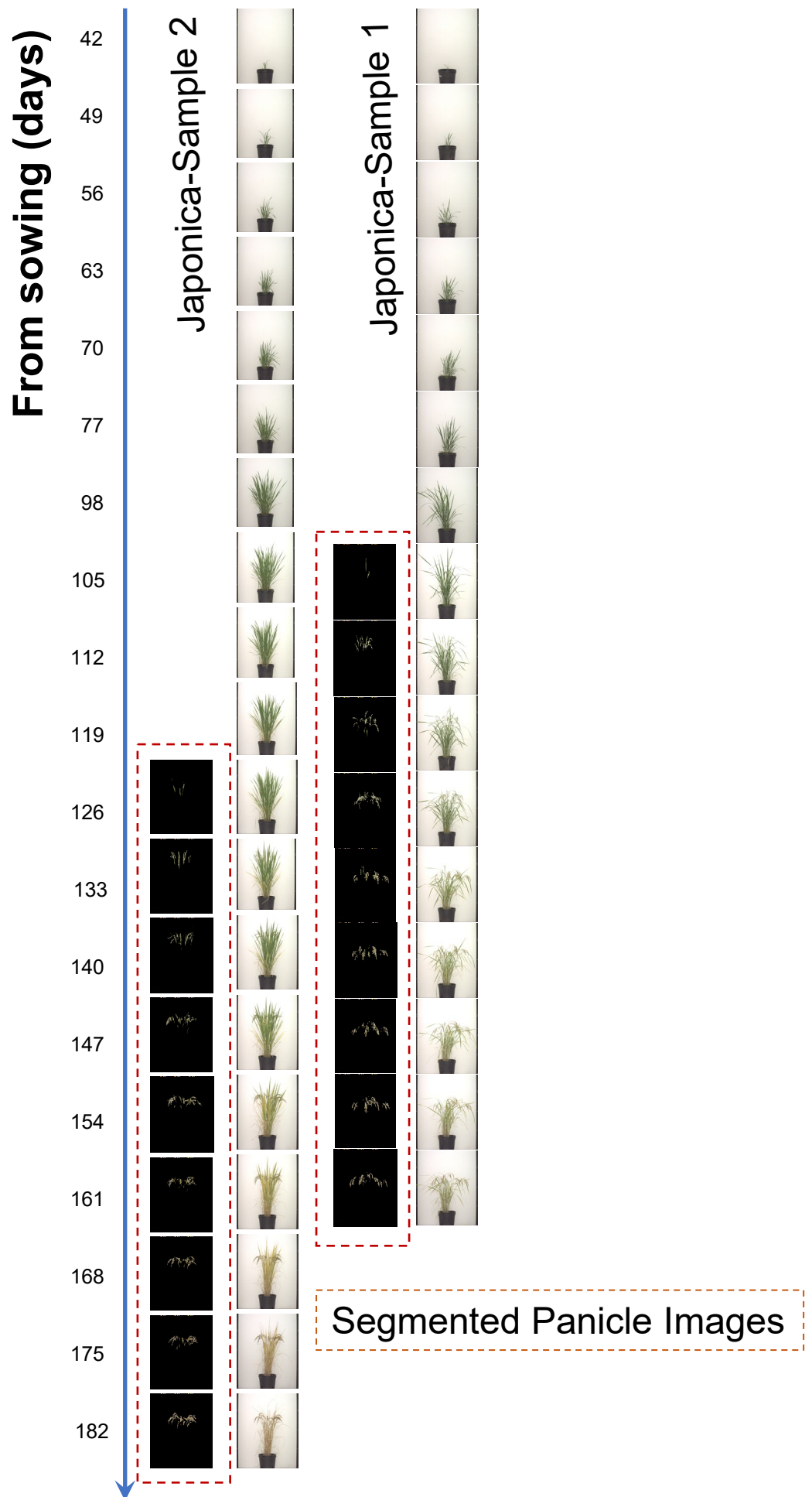


Supplementary Table S1. Literature information and the URL for accessing the plant image dataset

Dataset	URL	DOI/PMID
MTC_UAV	https://git.io/mtc-uav	10.1109/TGRS.2021.3058962
MTC	https://sites.google.com/site/poppinace/	29118821
WED	https://github.com/simonMadec	10.1016/j.agrformet.2018.10.013
URC	https://github.com/xdbai-source/Rice-Plant-Counting	37040495
RPC	https://git.io/sfc2net	33313541
GrainSpaceM	https://github.com/hellodfan/GrainSpace	10.48550/arXiv.2203.05306
GrainSpaceW	https://github.com/hellodfan/GrainSpace	10.48550/arXiv.2203.05306
GrainSpaceR	https://github.com/hellodfan/GrainSpace	10.48550/arXiv.2203.05306
Varieties	https://www.muratkoklu.com/datasets/	10.1109/ICDABI56818.2022.10041591
Durum	https://www.muratkoklu.com/datasets/vtd_hnd11.php	10.1016/j.compag.2019.105016
GWHD2021	http://www.global-heat.com/#about	34778804
PlantVillageM	https://github.com/spMohanty/PlantVillage-Dataset	-
PlantVillageS	https://github.com/spMohanty/PlantVillage-Dataset	-
Leafs_R	https://www.kaggle.com/datasets/shayanriyaz/riceleafs	-
LeafDiseaseM	https://www.kaggle.com/datasets/smaranjitghose/corn-or-maize-leaf-disease-dataset	-
LeafW	https://www.kaggle.com/datasets/olyadgetch/wheat-leaf-dataset	-
WGSR*	-	37304154
RootW	https://doi.org/10.5524/100343	29020747
ShootW	https://doi.org/10.5524/100343	29020747
RootNav2W	http://gigadb.org/dataset/100651	31702012
RootNav2A	http://gigadb.org/dataset/100651	31702012
RootNav2R	http://gigadb.org/dataset/100651	31702012
GWHD2020	https://zenodo.org/record/4298502	33313551
CosegPPB	https://zenodo.org/record/5117176	34473794
CosegPPF	https://zenodo.org/record/5117176	34473794
DeepPheno2017	https://figshare.com/s/e18a978267675059578f	30087695
ACID	http://plantimages.nottingham.ac.uk/	10.1109/ICCVW.2017.241
MAU-PID_A	http://cvlab.cse.msu.edu/multi-modality-imagery-database-msu-pid.html	10.1007/s00138-015-0734-6
MAU-PID_B	http://cvlab.cse.msu.edu/multi-modality-imagery-database-msu-pid.html	10.1007/s00138-015-0734-6
WeedMap	https://projects.asl.ethz.ch/datasets/doku.p	doi.org/10.3390/rs10091423

	hp?id=weedmap:remotesensing2018weed map	
PlantStress	https://projects.asl.ethz.ch/datasets/doku.p hp?id=2018plantstressphenotyping	30774703
SoybeanLeaves	https://data.mendeley.com/datasets/bycbh 73438/1	35028343
WeedDetectSoy	https://data.mendeley.com/datasets/3fmjm 7ncc6/2	10.1016/j.compag.2017.10.027
CassavaDisease	https://www.kaggle.com/c/cassava-diseas e/data	10.48550/arXiv.1908.02900
CassavaLeafDis	https://www.kaggle.com/c/cassava-leaf-di sease-classification/data	10.48550/arXiv.1908.02900
CassavaRoot	https://data.mendeley.com/datasets/gvp7v shvnh/3	32904393
DiseaseNLBboom	https://osf.io/p67rz/	29970178
DiseaseNLBdrone	https://osf.io/p67rz/	29970178
DiseaseNLBhand held	https://osf.io/p67rz/	29970178
WGSS*	-	-
WGSW144*	-	-
WGSW145*	-	-
WGSW151*	-	-
WGSW152*	-	-
WGSW165*	-	-
WGSW166*	-	-
WGSW172*	-	-
WGSW173*	-	-
WGSW179*	-	-
WGSW180*	-	-
WGSW186*	-	-
WGSW187*	-	-
WGSW193*	-	-
WGSW194*	-	-
WGSW200*	-	-
WGSW201*	-	-

Note: * indicates it is in-house, - not available.



Supplementary Figure S1. The schematic of rice images and segmented panicle images during the whole growth period.

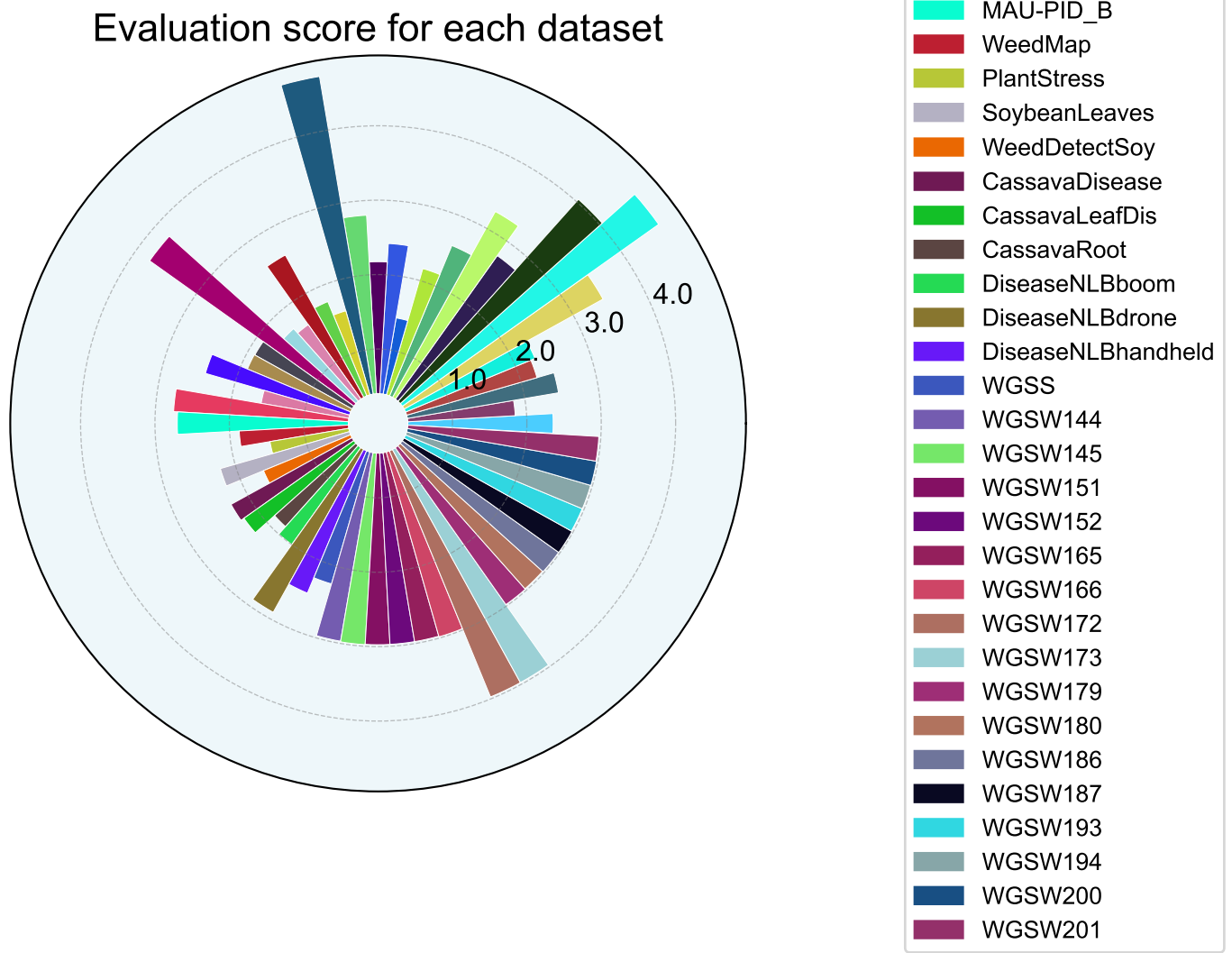
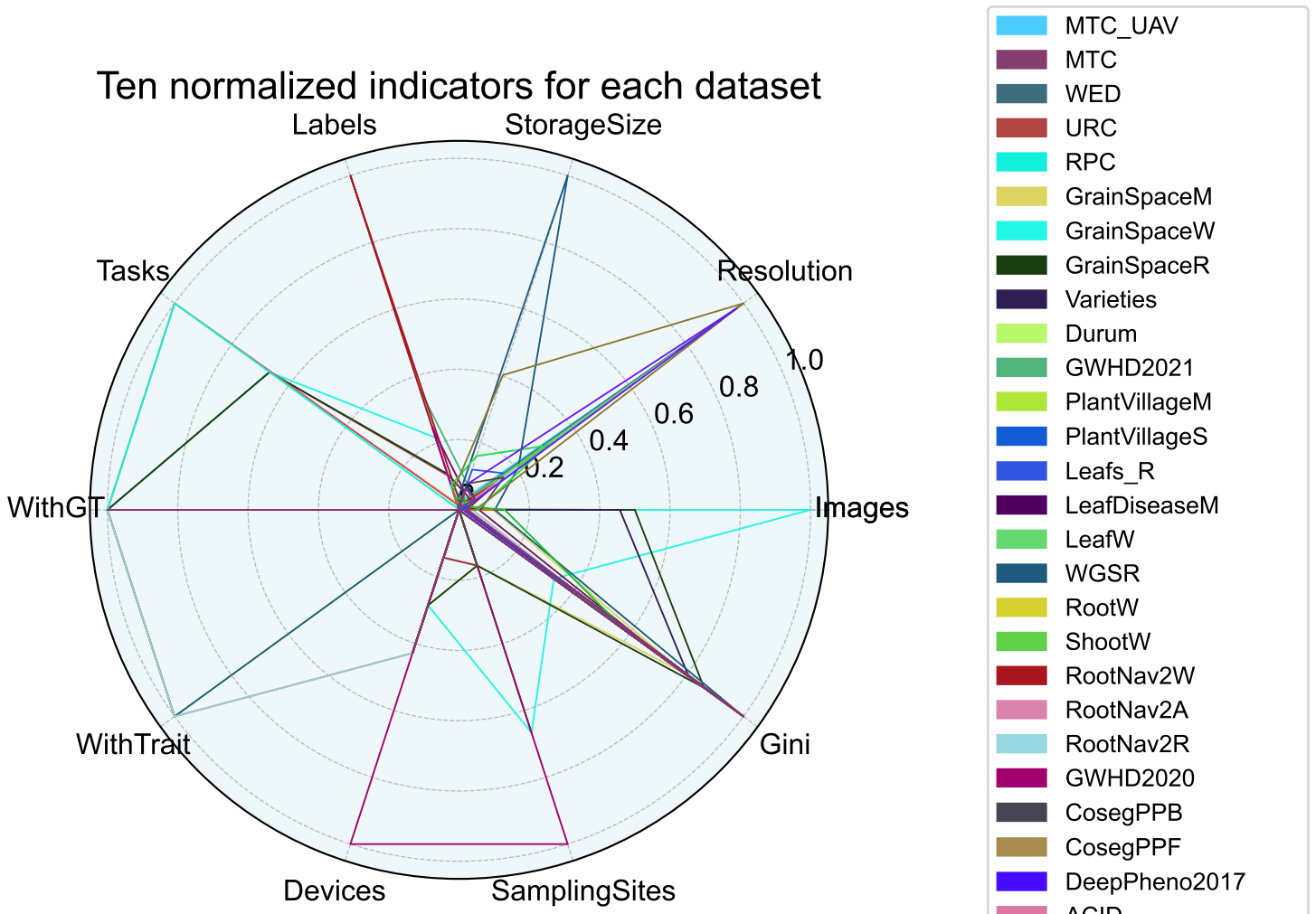
Supplementary Table S2. Description of the ten indicators that determine the evaluation score of a dataset

Indicator name	Description
Images	The total number of images in the dataset. A substantial account of plant image samples provides rich plant categories and features, contributing to paradigm-shifting in image-based phenotyping with sufficient training sets (1).
Resolution	The average of all image resolutions in the dataset. High-resolution images provide more details and clarity, which are crucial for plant identification and analysis tasks.
StorageSize	The storage size of the dataset. A larger storage size suggests the dataset includes more image samples and a diverse range of plant features.
Labels	The total number of the annotated instance in the dataset. A higher count of labelled instances provides more samples for training and validation, contributing to improved model performance.
Tasks	Quantifying the potential applications of the image dataset. The versatility and applicability of the dataset extend to a wide range of tasks, including but not limited to fine-grained recognition and disease detection. Thus, more potential applications of the dataset are invaluable resources for researchers and practitioners seeking a comprehensive dataset.
WithGT	Whether the dataset contains label information. The presence of plant class or attribute labels enables supervised learning tasks such as plant classification and detection.
WithTrait	Whether the dataset contains phenotypic traits analysed by image processing. The inclusion of additional trait data derived from plant images, such as plant height or green projected area, offers valuable digital characteristics that significantly contribute to facilitating further analysis, knowledge discovery, and reusability.

Devices	Quantifying the device prototypes in the dataset. Images captured from devices ensure the dataset contains multi-visual features, benefiting plant image recognition and analysis tasks.
SamplingSites	Quantifying the geographic locations of image dataset sampling (from several experimental sites). The incorporation of images taken from various experiment locations holds tremendous importance as it exemplifies the extensive scope and practicality of the dataset. By encompassing images from diverse environments, the dataset can precisely portray and capture the inherent diversities present in plants across different settings, thereby enhancing its overall representativeness and applicability.
Gini	Class balance, as measured by the Gini index, serves as a means to evaluate the distribution equilibrium within an image classification dataset. A higher Gini index value signifies a more uniform allocation of samples among each category.

Reference:

1. Pound, M.P., Atkinson, J.A., Townsend, A.J., Wilson, M.H., Griffiths, M., Jackson, A.S., Bulat, A., Tzimiropoulos, G., Wells, D.M., Murchie, E.H. *et al.* (2017) Deep machine learning provides state-of-the-art performance in image-based plant phenotyping. *GigaScience*, **6**, 1-10.

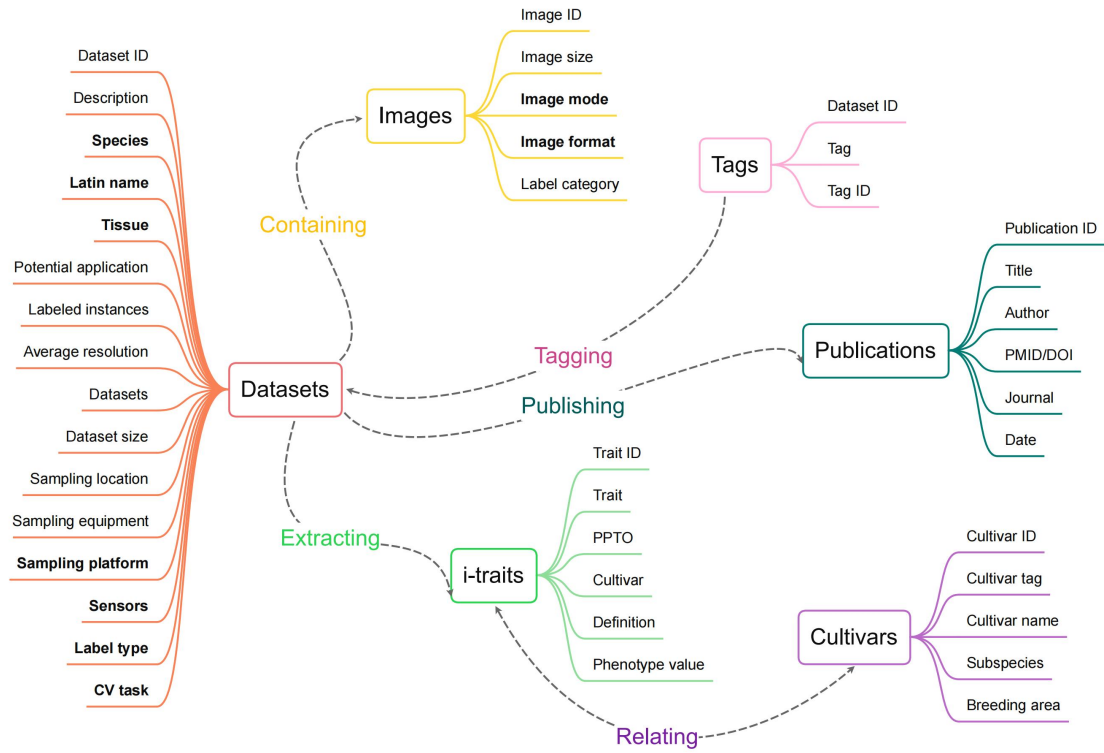


Supplementary Figure S2. The ten indicators and the final evaluation score of each dataset.

Supplementary Table S3. The definitions and categories of i-traits

Category	i-trait
Plant related traits	The height of whole plant
	The total projected area of whole plant
	The ratio of height and width of whole plant
	The ratio of total projected area and height of whole plant
	The ratio of yellow projected area and total projected area of whole plant
Panicle related traits	The total projected area of panicle
	Value of final total projected area of panicle
	The ratio of projected area of panicle and whole plant
	The ratio of yellow projected area and total projected area of panicle
	The yellow projected area of panicle
Culm related traits	The height of plant culm
	The total projected area of plant culm
	The ratio of projected area and height of plant culm
	The ratio of green projected area and total projected area of plant culm
	The ratio of yellow projected area and total projected area of plant culm
	The ratio of height of culm and whole plant
Grain related traits	Mean value of grain length
	Mean value of grain length / width ratio
	Mean value of grain width
	Total spikelet number
	1,000-grain weight
	Yield per plant (filled grain weight)
	Spikelet fertility
	Filled grain number
Phenological traits	The days to harvest from sowing
	The days to the beginning of heading from sowing
	The days to the maximum value of height of whole plant from sowing
	The days to the maximum value of total projected area of whole plant from sowing
	The days to the maximum value of ratio of yellow projected area and total projected area of whole plant from sowing
	The days to the maximum value of green projected area of whole plant from sowing
	The days to the maximum value of total projected area of whole plant from heading
	The days to the maximum value of the ratio of projected area of panicle and whole plant from heading
	The days to the maximum value of ratio of yellow projected area and total projected area of panicle from heading
	The days to the maximum value of yellow projected area of panicle

	from heading
Panicle development related traits	Value of daily growth of total projected area of panicle
	Value of daily growth of ratio of projected area of panicle and whole plant
	Value of daily growth of ratio of yellow projected area and total projected area of panicle
	Value of daily growth of yellow projected area of panicle
Plant growth related traits	Value of daily growth of height of whole plant
	Value of daily growth of total projected area of whole plant
	Value of daily growth of the ratio of yellow projected area and total projected area of whole plant
Panicle related traits	Correlation
	Small gradient advantage
	Large gradient advantage
	Energy
	Uneven distribution of gray scale
	Uneven gradient distribution
	Gray mean
	Gradient mean
	Gray entropy
	Gradient entropy
	Entropy of mixing
	Difference moment
	Partial moment of deficit
	Gray standard deviation
	Gradient standard deviation



Supplementary Figure S3. The metadata for datasets and images (the fields in bold are controlled vocabularies).