A global dataset gathering 37 field experiments involving cereal-legume intercrops and their corresponding sole crops

Noémie Gaudio[1]*, Rémi Mahmoud[1], Laurent Bedoussac[2], Eric Justes[1,3], Etienne-Pascal Journet[1,4], Christophe Naudin[5], Henrik Hauggaard-Nielsen[6], Erik Steen Jensen[7], Elise Pelzer[8], Guénaëlle Corre-Hellou[5], Bochra Kammoun[1,9], Loïc Viguier[1,10], Romain Barillot[11], Antoine Couëdel[12], Philippe Hinsinger[13], Pierre Casadebaig[1]

(1) AGIR, Univ Toulouse, INRAE, Castanet-Tolosan, France
(2) AGIR, Univ Toulouse, ENSFEA, INRAE, Castanet-Tolosan, France
(3) CIRAD, Persyst Department, Montpellier, France
(4) LIPME, Univ Toulouse, CNRS, Castanet-Tolosan, France
(5) USC LEVA, ESA, INRAE, Angers, France
(6) Department of People and Technology, Roskilde University, Roskilde, Denmark
(7) Department of Biosystems and Technology, Swedish University of Agricultural Sciences, P.O. Box 103, 230 53 Alnarp, Sweden
(8) UMR Agronomie, Univ Paris-Saclay, INRAE, AgroParisTech, Palaiseau, France
(9) ARVALIS-Institut du Végétal, Paris, France
(10) ARVALIS-Institut du Végétal, Direction Recherche & Développement, Baziège, France
(11) URP3F, INRAE, Lusignan, France
(12) AIDA, Univ Montpellier, CIRAD, Montpellier, France
(13) Eco&Sols, Univ Montpellier, CIRAD, INRAE, IRD, Institut Agro, Montpellier, France

(*) Corresponding author (noemie.gaudio@inrae.fr)

The dataset is stored on Zenodo data repository (Gaudio et al., 2023): https://doi.org/10.5281/zenodo.8081577.
The associated data workflow is described in the following reference (Mahmoud et al., 2024): https://doi.org/10.24072/pcjournal.389.

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Authors' contributions

Data providers and field experiments: Laurent Bedoussac, Eric Justes, Etienne-Pascal Journet, Christophe Naudin, Henrik Hauggaard-Nielsen, Erik Steen Jensen, Elise Pelzer, Guénaëlle Corre-Hellou, Bochra Kammoun, Loic Viguier, Romain Barillot, Antoine Couëdel, Philippe Hinsinger

Database and management: Noémie Gaudio, Rémi Mahmoud, Pierre Casadebaig

Main features of the global dataset

This global dataset gathers the results of 37 field experiments, which involved cereal-legume intercrops and their corresponding sole crops. The field experiments were carried in 5 European countries (France, Denmark, Italy, Germany and England) from 2001 to 2017. The global dataset includes:

- 5 legume species, *i.e.* chickpea (*Cicer arietinum* L.), faba bean (*Vicia faba* L.), lentil (*Lens culinaris* Med.), lupin (*Lupinus albus* L.) and pea (*Pisum sativum* L.),
- 3 cereal species, *i.e.* barley (*Hordeum vulgare* L.), durum wheat (*Triticum turgidum* L.) and soft wheat (*Triticum aestivum* L.),
- 8 resulting intercrops, *i.e.* i) barley associated with faba bean, lupin or pea, ii) durum wheat associated with chickpea, faba bean or pea, and iii) soft wheat associated with lentil or pea.

In total, the global dataset contains 299 sole crop and 308 intercrop experimental units, one given experimental unit being defined as the unique combination of {site, year, crop management}, with the crop management including species and cultivar choice as well as agricultural interventions (sowing conditions, inputs, …).

The global dataset includes four tables (Figure 1), all sharing a common identifier (*experiment_id*):

- *data_trials.csv*: the global features describing the experimental sites,
- *data_management.csv*: the agricultural management actions carried out on each of the experimental sites,
- *data_traits.csv*: measured plant and crop characteristics,
- *data_climate.csv*: climate for the experimental sites, retrieved from NASA POWER API (Sparks, 2018).

Additionally, a metadata file is provided (*metadata.xlsx*), describing the table to which the variables belong (*variable_type*, *i.e.* trials, management, traits or climate), their name (*variable_name*), their significance (*description*) and their unit (*unit*). Finally, a table including the original references related to the experimental files gathered is also provided (*references.xlsx*), listing the reference publications for 26 of the 37 experiments (Knudsen et al., 2004; Corre-Hellou et al., 2006; Hauggaard-Nielsen et al., 2008; Hauggaard-Nielsen et al., 2009a; b; Launay et al., 2009; Bedoussac and Justes, 2010a; b; Naudin et al., 2010, 2014; Barillot et al., 2014; Pelzer et al., 2016; Tang et al., 2016; Viguier et al., 2018; Kammoun et al., 2021). An overview of the global dataset is presented hereafter, focusing on crop species grown and the plant measurements.

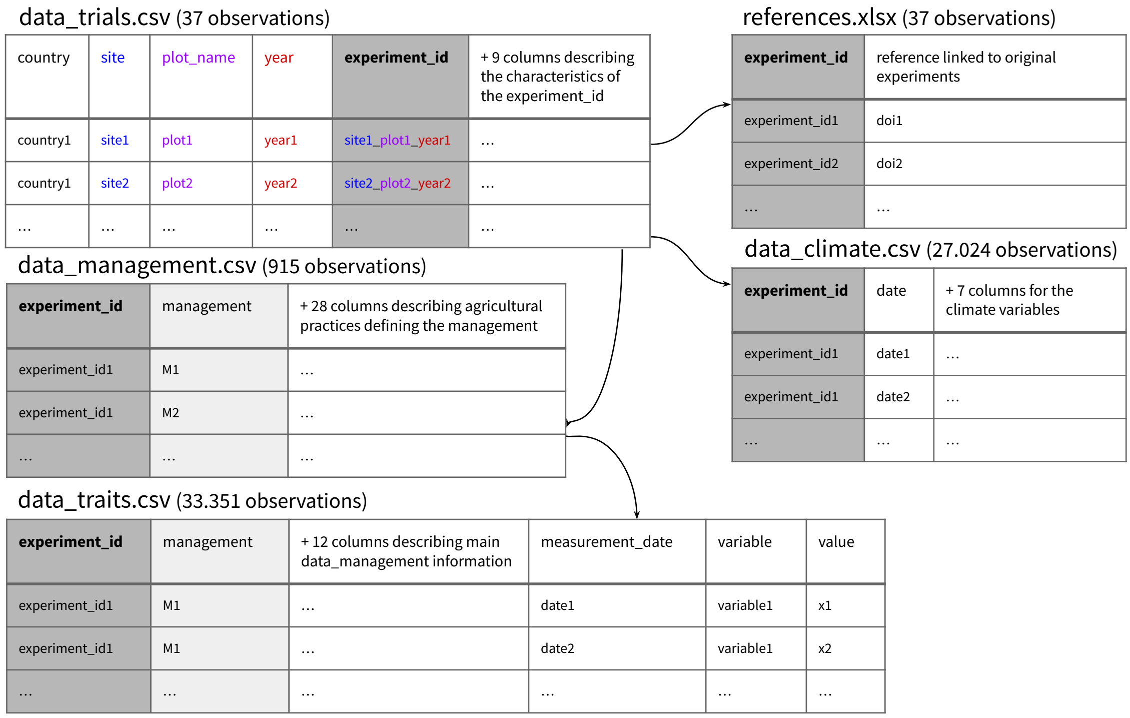

Figure 1. Representation of the relationships between tables identified in the global dataset. Five tables were defined to organize data, all sharing a common identifier (experiment_id, which is the concatenation of the site_plot_year of each experiment). The table *data_trials.csv* provides the main characteristics (*e.g.* latitude/longitude, soil texture) of each site, with one line per experiment (37 observations). The table *data_climate.csv* provides the climate time series during the growing season for each experiment (27.024 observations), retrieved using a gridded API (NASA POWER API, Sparks (2018)). The table *data_management.csv* describes the different agricultural practices used in each experimentation (*e.g.* species grown in sole- or intercrop, genotype, fertilization). The table *data_traits.csv* provides all the plant variables and their value as a function of time (measurement) per management and experiment (33.351 observations). Finally, the table *references.xlsx* provides the initial experimental references linked to each experiment (when existing).

Focus on the crop species cultivated

The global dataset includes 8 crop species (Table 1), among wich 3 cereals (barley, durum and soft wheat) and 5 grain legumes (chickpea, faba bean, lentil, lupin, and pea). Each species can be grown in one or more experiment, with one experiment corresponding to a unique combination of {site, year}, and is represented by 1 or more cultivars.

Table 1. Summary of crop species included in the global dataset.

Plant family	Cropping season	Species	No. Cultivars	No. Experiments
cereal	spring	barley	3	15
cereal	spring	soft wheat	2	2
cereal	winter	soft wheat	6	12
cereal	winter	durum wheat	7	8
legume	spring	fababean	1	6
legume	spring	lentil	4	2
legume	spring	lupin	1	6
legume	spring	pea	3	15
legume	winter	chickpea	1	1
legume	winter	fababean	4	5
legume	winter	pea	13	17

Each experiment includes at least one cereal-legume species mixture, with the two species sown simultaneously in winter or spring, resulting in 8 types of intercrops (Table 2).

Table 2. Summary of intercrops (cereal_legume) included in the global dataset.

Cropping season	Intercrop	No. Experiments
spring	barley_fababean	6
spring	barley_lupin	6
spring	barley_pea	15
spring	soft wheat_lentil	2
winter	soft wheat_pea	12
winter	durum wheat_chickpea	1
winter	durum wheat_fababean	5
winter	durum wheat_pea	5

Focus on the plant characteristics measured

Pooling the 37 field experiments, a total of 30 plant variables were measured, but not systematically in all experiments (Table 3). Some of these variables were measured dynamically during the growth cycle. Finally, the global dataset contains 34737 observations, among which 13428 were measured in sole crops and 21309 in intercrops.

Table 3. Summary of plant variables (see metadata file for the precise meaning of each variable) included in the global dataset.

Plant variable	No. Experiments
biomass seed	37
biomass shoot	37
BBCH	35
plant density	32
height	31
nitrogen abs shoot	30
tkw	30
nitrogen seed	29
nitrogen abs seed	24
nitrogen shoot	22
nitrogen veg	20
lai	18
nitrogen abs veg	15
cover	12
nitrogen abs shoot fixation	11
reproductive organ number	10
biomass stem	9
sla greenleaftendril	9
biomass leaf	8
branching	8
biomass leaftendril	7
carbon nitrogen shoot	7
carbon shoot	7
flower layer	7
leaf layer	6
rie	6
biomass greenleaftendril	5
biomass senescleaf	5
carbon seed	5
carbon veg	5

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