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Data Article

A dataset on service crop phenotypic characteristics related to their ability to deliver a set of ecological functions

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ABSTRACT

The dataset presented in this article describe 33 species or varieties of service crops cultivated in population under non-limiting conditions. The description was made at flowering. 41 variables were measured on leaves, stems, roots and seeds. They related to plant phenology (1), morphology (13), physiology (1), biochemistry (18), size (6) and reproduction (2). This dataset is made available to enable comparisons between datasets, extended analysis and meta-analysis on cover crops. The data presented in this article were partly used in the research article entitled “A trait-based characterization of cover plants to assess their potential to provide a set of ecological services in banana cropping systems” (Damour et al., 2014).

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Specifications Table

Subject	Agricultural and Biological Sciences (General)
Specific subject area	Description of service crops and to be uses in multi-species cropping systems expected to deliver ecosystem services
Type of data	Table
How data were acquired	Field measures of plants and populations. Instruments and methods: Scanner and WinRhizo Pro analytical software (Regent Instruments) for leaf area measurements 10 cm × 10 cm mesh grid positioned on vertical soil profiles for root impacts observations CHN analyser (Elementar Vario Macro Cube) and Dumas method for total C and N quantification ICP-AES (Agilent 720) for P, K, Mg, Ca quantification
Data format	Raw Analyzed
Parameters for data collection	Service crops were grown on andosols, under rain-fed regime and with no fertilization. The field was previously a highly fertilized banana crop; at the beginning of the experiment, the soil contained 65.6 g organic matter kg ⁻¹ , 38.0 g C kg ⁻¹ , 3.84 g N kg ⁻¹ and 3.8 mg P kg ⁻¹ , with a pH of 5.65. The mean annual rainfall of the site was 3450 mm. Mean air temperature was 24 °C. These conditions were non-limiting for growth.
Description of data collection	The data were collected at the flowering stage of each species/variety on plant populations or individuals. For each species/variety, the aboveground biomass was collected on three 1m ² and pooled; the organs were separated and weighted; leaf areas were measured. On each plot, three 1m-deep and 1 m-wide trenches were dug perpendicularly to the plantation rows and root impacts on the vertical soil profile were counted. Finally, on each plot, three individual plants were collected and their root system extracted from the soil; aboveground organs and roots were pooled, to describe the "mean plant" of the population, and weighted; chemical analysis were performed on these materials.
Data source location	City/Town/Region: Experimental station of Neufchateau, Capesterre Belle Eau Country: Guadeloupe, French West Indies Latitude and longitude (and GPS coordinates) for collected samples/data: 16°05'N, 61°35'W
Data accessibility	Repository name: Cirad Dataverse Data identification number: / Direct URL to data: doi:10.18167/DVN1/EZPGCP
Related research article	Damour G et al. 2014, A trait-based characterization of cover plants to assess their potential to provide a set of ecological services in banana cropping systems, <i>European Journal of Agronomy</i> , http://dx.doi.org/10.1016/j.eja.2013.09.004 .

Value of the data

- The data represent plant, leaf and root descriptions of a large range of service crop species. They could be used by other researchers who need data on these species.
- The data enable other researchers to compare their own data with this dataset and to extent their analysis.
- These data could be used in meta-analysis on service crops.

1. Data description

The dataset presented in this article (doi:10.18167/DVN1/EZPGCP) is composed of 42 variables measured on 33 species or varieties of service crops at flowering. The length of the growing period is also reported, along with the sowing density and the plant density at the date of measurements. The list of the variables is provided in [Table 1](#). Some of them describe the

Table 1

List of the variables provided in the dataset.

Abbreviation	Variable name	Function	Organ
DAS	number of days after sowing	/	/
d_{sow}	sowing density	/	/
d_{plant}	number of individuals / m ²	/	/
cycle	duration of plant life cycle	phenology	plant
SRR	shoot/root ratio	morphology	plant
QN	quantity of nitrogen in the whole plant	biochemistry	plant
BM_a	total aboveground dry biomass	size	aboveground organs
H	plant height	size	aboveground organs
GH	growth habit	morphology	aboveground organs
DMC_a	aboveground dry matter content	biochemistry	aboveground organs
$[N]_a$	aboveground N content	biochemistry	aboveground organs
$[C]_a$	aboveground C content	biochemistry	aboveground organs
CN_a	aboveground C/N ratio	biochemistry	aboveground organs
$[P]_a$	aboveground P content	biochemistry	aboveground organs
$[K]_a$	aboveground K content	biochemistry	aboveground organs
$[Mg]_a$	aboveground Mg content	biochemistry	aboveground organs
$[Ca]_a$	aboveground Ca content	biochemistry	aboveground organs
QN_a	quantity of nitrogen in the aboveground organs	biochemistry	aboveground organs
BM_l	green leaf dry biomass	size	leaf
LAI	leaf area index	morphology	leaf
LMF_a	aboveground leaf mass fraction	morphology	leaf
SLA_{ps}	specific area at the plant scale	morphology	leaf
LAR_a	aboveground leaf area ratio	morphology	leaf
DMC_l	green leaf dry matter content	biochemistry	leaf
BM_{sl}	stem & litter dry biomass	size	stem & litter
DMC_{sl}	stem & litter dry matter content	biochemistry	stem & litter
BM_r	root dry biomass	size	root
RD	mean rooting depth	size	root
RID_{mean}	mean root impact density on the whole soil profile	morphology	root
RID_{0-10}	root impact density in the 0–10 soil layer	morphology	root
RID_{10-20}	root impact density in the 10–20 soil layer	morphology	root
RID_{20-30}	root impact density in the 20–30 soil layer	morphology	root
RID_{30-40}	root impact density in the 30–40 soil layer	morphology	root
RID_{40-50}	root impact density in the 40–50 soil layer	morphology	root
RID_{50-60}	root impact density in the 50–60 soil layer	morphology	root
Nod	presence of nodules	physiology	root
$[N]_r$	root N content	biochemistry	root
$[C]_r$	root C content	biochemistry	root
CN_r	root C/N ratio	biochemistry	root
$[P]_r$	root P content	biochemistry	root
$[K]_r$	root K content	biochemistry	root
$[Mg]_r$	root Mg content	biochemistry	root
$[Ca]_r$	root Ca content	biochemistry	root
SM	seed fresh mass	reproduction	seed
Veg	capacity of the plant to reproduce from vegetative organs	reproduction	seed

plant populations (*i.e.* they are on a m² basis) (22 variables), others the individual plant (20 variables). They related to plant phenology (1 variable), morphology (13 variables), physiology (1 variable), biochemistry (19 variables), size (6 variables) and reproduction (2 variables). They concern different plant organs: leaves (6 variables), stems and litter (2 variables), roots (17 variables), seeds (2 variables). Three other variables concern the whole plant, and 12 the aboveground parts of the plants. Most of variables are quantitative but four are qualitative. The list of the species and varieties is provided in [Table 2](#), along with their taxonomic groups and families. The dataset is composed of 26 different species that belong to seven taxonomic families. Two species are represented by several varieties: *Sorghum bicolor* (3 varieties) and *Vigna unguiculata* (6 varieties). [Table 3](#) presents a selection of 18 variables and 33 species/variety from the dataset. For one variable (height, H), the mean over 1 individuals and the associated standard deviation

Table 2

List of the species/cultivars included in the dataset.

Abbreviation	Species name	Botanical classification	Family
ArachPin	<i>Arachis pintoii</i>	dicot	Fabaceae
BrachDec	<i>Brachiaria decumbens</i>	monocot	Poaceae
BrachRuz	<i>Brachiaria ruziziensis</i>	monocot	Poaceae
CajCaj	<i>Cajanus cajan</i> var. <i>Guadeloupe</i>	dicot	Fabaceae
CentPas	<i>Centrosema pascuorum</i>	dicot	Fabaceae
CrotalPal	<i>Crotalaria pallida</i>	dicot	Fabaceae
CrotJunc	<i>Crotalaria juncea</i>	dicot	Fabaceae
CrotRet	<i>Crotalaria retusa</i>	dicot	Fabaceae
CrotSpec	<i>Crotalaria spectabilis</i>	dicot	Fabaceae
CrotZanz	<i>Crotalaria zanzibarica</i>	dicot	Fabaceae
CynDact	<i>Cynodon dactylon</i>	monocot	Poaceae
DolLab	<i>Dolichos lablab</i>	dicot	Fabaceae
ElCor	<i>Eleusine coracana</i>	monocot	Poaceae
FagEsc	<i>Fagopyrum esculentum</i>	dicot	Polygonaceae
GlirSep	<i>Gliricidia sepium</i>	dicot	Fabaceae
ImpWal	<i>Impatiens waleriana</i>	dicot	Balsaminaceae
NeoWigh	<i>Neonotonia wightii</i>	dicot	Fabaceae
PaspNot	<i>Paspalum notatum</i>	monocot	Poaceae
PuerPhas	<i>Pueraria phaseolides</i>	dicot	Fabaceae
RicCom	<i>Ricinus communis</i>	dicot	Euphorbiaceae
SesbCer	<i>Sesbania cericea</i>	dicot	Fabaceae
SesInd	<i>Sesamum indicum</i>	dicot	Pedaliaceae
SorgBF80	<i>Sorghum bicolor</i> var. <i>BF80</i>	monocot	Poaceae
SorgPap	<i>Sorghum bicolor</i> var. <i>papetier</i>	monocot	Poaceae
SorgWal	<i>Sorghum bicolor</i> var. <i>walagana</i>	monocot	Poaceae
StylGua	<i>Stylosanthes guianensis</i>	dicot	Fabaceae
TagPat	<i>Tagetes patula</i>	dicot	Asteraceae
VignCNC	<i>Vigna unguiculata</i> var. <i>CNC</i>	dicot	Fabaceae
VignDav	<i>Vigna unguiculata</i> var. <i>David</i>	dicot	Fabaceae
VignMor	<i>Vigna unguiculata</i> var. <i>Morondava</i>	dicot	Fabaceae
VignSPLM1	<i>Vigna unguiculata</i> var. <i>SPLM1</i>	dicot	Fabaceae
VignSPLM2	<i>Vigna unguiculata</i> var. <i>SPLM2</i>	dicot	Fabaceae
VignU462	<i>Vigna unguiculata</i> var. <i>U462</i>	dicot	Fabaceae

are presented. These variables were chosen because of their high relevance for ecology and/or agronomy studies. They include the variables used in the related research article Damour et al. [1].

2. Experimental design, materials, and methods

The experiment was conducted at the CIRAD experimental station of Neufchâteau in Guadeloupe (French West Indies) on andosols [2]. Mean annual rainfall and temperature provide favourable conditions for plant growth all year round (3450 mm and 24 °C respectively, means calculated over the 2009–2013 period). The field was previously a highly fertilized banana crop. At the beginning of the experiment, the soil contained 65.6 g organic matter kg⁻¹, 38.0 g C kg⁻¹, 3.84 g N kg⁻¹ and 3.8 mg P kg⁻¹, with a pH of 5.65. 33 species or varieties of services crops were studied (Table 2). Among them, 32 were manually sown, each on a 200 m² plot along 30-cm spaced rows. The sowing density (d_{sow}) was determined according to seed size. Three densities were used: 0.2, 0.5, 2 g of seeds/m². The last species (*Impatiens* sp), a shade-tolerant pluri-annual plant that easily grow from cuttings, was naturally growing in banana field on the experimental station. This species was observed on a plot where the few other spontaneous species were removed. The plots were rain-fed and no fertilization was applied as the previous crop was a highly fertilized banana crop that has provided high amounts of nutrients for the following crops.

Table 3

Selection of variables and species/variety from the dataset. For H, the mean value over 10 individuals is followed by the standard deviation in brackets.

Species	cycle	Bma	H	GH	DMCa	[N]a	CNa
ArachPin	perennial	1.477	NA	creeping	16.96	2.091	17.575
BrachDec	perennial	2.583	NA	erected	29.47	0.500	90.000
BrachRuz	perennial	1.074	NA	erected	27.94	0.410	108.268
CajCaj	perennial	1.393	NA	erected	38.44	2.070	23.464
CentPas	annual	0.085	NA	erected	22.55	2.700	16.959
CrotalPal	annual	0.548	1.44 (0.07)	erected	20.62	1.256	36.903
CrotJunc	annual	0.321	3.24 (0.21)	erected	23.85	1.513	29.551
CrotRet	annual	0.655	NA	erected	20.64	2.380	19.046
CrotSpec	annual	0.278	1.15 (0.08)	erected	12.15	1.502	28.522
CrotZanz	annual	0.816	NA	erected	28.88	2.634	18.265
CynDact	perennial	1.243	NA	creeping	42.95	1.880	23.553
Dollab	pluri-annual	0.444	0.70 (0.09)	twining	18.06	2.997	14.755
ElCor	short annual	0.407	NA	erected	20.96	2.660	16.297
FagEsc	short annual	0.063	NA	erected	9.50	4.353	9.026
GlirSep	perennial	1.526	NA	erected	25.71	1.390	34.496
ImpWal	pluri-annual	0.194	NA	semi-erected	6.91	2.930	13.713
NeoWigh	perennial	0.742	NA	twining	19.09	3.349	14.124
PaspNot	perennial	0.128	0.38 (0.04)	creeping	23.41	1.269	32.569
PuerPhas	perennial	0.807	0.67 (0.05)	twining	13.87	2.405	18.079
RicCom	perennial	0.524	NA	erected	22.50	2.140	20.542
SesbCer	annual	1.202	3.52 (0.39)	erected	27.15	1.668	27.152
SesInd	short annual	0.646	1.52 (0.20)	erected	24.30	2.406	21.047
SorgBF80	short annual	0.611	2.79 (0.53)	erected	18.40	1.611	27.337
SorgPap	short annual	1.020	5.54 (0.40)	erected	15.05	1.573	25.671
SorgWal	annual	2.932	4.94 (0.33)	erected	22.83	1.450	30.028
StylGua	pluri-annual	0.216	0.79 (0.06)	erected	20.27	2.607	16.494
TagPat	short annual	0.085	NA	erected	13.55	1.860	23.640
VignCNC	short annual	0.148	NA	semi-erected	12.96	3.295	12.992
VignDav	short annual	0.098	NA	semi-erected	11.05	4.497	9.875
VignMor	short annual	0.259	0.55 (0.06)	semi-erected	13.02	2.753	15.950
VignSPLM1	annual	0.245	0.40 (0.04)	semi-erected	12.66	2.142	20.761
VignSPLM2	short annual	0.195	NA	semi-erected	11.62	2.893	14.452
VignU462	short annual	0.126	NA	semi-erected	12.80	3.314	12.993

Species	LAI	LMFa	SLAps	LARa	QNa	RD	RIDmean	Nod	CNr	SM
ArachPin	12.59	0.11	42.71	4.79	30.90	24.91	2.6	yes	22.259	155.0
BrachDec	44.65	0.99	19.96	19.69	12.92	21.57	15.5	no	128.861	5.8
BrachRuz	17.48	0.91	23.00	21.01	4.66	21.52	19.4	no	120.605	16.0
CajCaj	1.49	0.07	16.13	1.09	29.89	24.48	3.3	yes	58.142	105.0
CentPas	3.30	0.47	18.62	8.74	2.42	21.62	5.4	yes	16.325	20.0
CrotalPal	5.30	0.32	30.47	9.76	8.83	23.47	6.9	yes	13.137	6.0
CrotJunc	2.77	0.36	23.27	8.43	5.43	25.02	10.1	yes	33.638	45.2
CrotRet	6.44	0.35	28.31	9.98	16.03	30.55	2.5	yes	46.470	22.0
CrotSpec	4.52	0.56	29.33	16.29	4.66	20.76	11.7	yes	36.103	6.0
CrotZanz	6.60	0.24	33.33	8.04	22.34	19.97	5.0	yes	41.945	4.0
CynDact	15.83	1.00	14.85	14.85	23.39	20.85	8.7	no	61.400	1.5
Dollab	2.55	0.27	21.05	5.72	13.60	18.85	4.5	yes	34.268	245.0
ElCor	1.43	0.26	14.03	3.67	12.02	10.48	0.8	no	28.447	3.0
FagEsc	1.36	0.51	38.50	19.44	3.04	18.00	NA	no	23.018	22.8
GlirSep	5.21	0.16	21.52	3.48	25.31	19.56	1.9	yes	35.162	109.7
ImpWal	11.97	0.88	8.57	7.54	6.40	5.32	1.9	no	13.889	NA
NeoWigh	4.17	0.96	38.54	36.87	25.47	19.23	2.9	yes	22.861	14.0
PaspNot	1.49	1.00	11.93	11.93	1.97	16.67	13.1	no	87.134	4.0
PuerPhas	3.50	0.14	31.27	4.34	NA	22.53	7.1	yes	33.603	14.0
RicCom	1.96	0.24	16.22	3.84	11.73	33.72	2.6	no	57.705	170.0
SesbCer	6.17	0.22	23.68	5.13	23.44	22.18	9.0	yes	23.376	8.0
SesInd	2.36	0.16	23.18	3.69	15.77	24.15	3.6	no	90.845	1.3
SorgBF80	3.38	0.21	26.03	5.58	10.22	31.86	4.5	no	68.193	19.6
SorgPap	4.25	0.23	18.18	4.18	16.47	35.12	4.5	no	53.867	23.0
SorgWal	13.33	0.21	21.14	4.42	43.93	21.47	15.7	no	100.329	28.4
StylGua	2.63	0.45	27.34	12.22	6.11	22.45	6.0	yes	22.997	5.0
TagPat	1.06	0.45	27.59	12.35	1.65	23.95	6.9	no	63.771	4.0
VignCNC	1.80	0.44	28.62	12.53	5.01	27.42	4.1	yes	27.211	135.0
VignDav	1.27	0.43	30.60	13.22	4.62	32.19	3.0	yes	20.730	155.68
VignMor	2.73	0.31	34.33	10.56	7.30	33.54	2.7	yes	40.446	155.68
VignSPLM1	2.33	0.28	34.48	9.49	5.41	26.81	2.6	yes	32.384	170.0
VignSPLM2	1.73	0.29	30.42	8.89	5.89	36.36	2.9	yes	28.316	162.0
VignU462	1.31	0.38	27.03	10.16	4.26	36.34	4.3	yes	24.942	155.68

Plant measurements were done at the flowering stage of each species/variety (when flowers were observed on 50% of the individuals) (**DAS**, the number of day between sowing and measurements). 41 variables related to plant phenology, morphology, size, physiology, biochemistry and reproduction were selected. They were chosen because of i) their complementarity to describe the different facets of plant functioning, ii) their high relevance for ecology and/or agronomy studies, ii) and their assumed relationship with the functions underlying the delivery of ecosystem services, particularly in banana agrosystems [1,3,4,5].

The duration of the plant life cycle (**cycle**) was scored according to four classes: short annual (< 3 months), annual, pluri-annual, and perennial. The growth habit (**GH**) was qualified as twining, creeping, semi-erected, or erected. The capacity of the plant to reproduce from vegetative organs (**Veg**) was determined from field observations (observation of vegetative multiplying organs - rhizome or stolons - or the ability of plants to grow from cuttings).

The density of plants at the time of measurements (**d_{plant}**) was counted within a 1m² frame.

Plant height (**H**) was measured as the distance between the ground level and the upper boundary of the vegetative tissues [5]. It was measured on 10 individuals within the population and averaged.

On each plot, plants' aboveground organs were collected on three 1 m² squares randomly chosen in the experimental plot and pooled. The green leaves were separated from the stems and dead leaves (called hereafter "litter"). All plant parts were stored in a cooler, which was kept moist using wet paper towel, until measurements. Just after collection, the cooler was brought to the laboratory. Green leaves on the one hand and stems and litter on the other hand were weighted. Immediately after, the total leaf area was determined from a sub-sample of leaves using a scanner and WinRhizo pro (Regent Instruments). The leaf area index (**LAI**) was then calculated as the total leaf area divided by the soil area from which the plants were collected (i.e. 3 × 1m²). Green leaves on the one hand and stems and litter on the other hand were then oven-dried at 70 °C for 72 h and weighted to determine their dry biomasses on a soil area basis (green leaf dry biomass, **BM_l**, and stem and litter dry biomass, **BM_{sl}**). The total aboveground dry biomass on a soil area basis (**BM_a**) was then calculated as the sum of BM_l and BM_{sl}. The aboveground leaf mass fraction (**LMF_a**) was calculated as the ratio between BM_l and BM_a. The specific leaf area on a plant scale (**SLA_{ps}**) was calculated as the ratio between the total leaf area and BM_l. The aboveground leaf area ratio (**LAR_a**) was calculated as the product of SLA_{ps} and LMF_a. Green leaf dry matter content (**DMC_l**) and stem and litter dry matter content (**DMC_{sl}**) were determined as the ratio between their dry weights and their fresh weights. Aboveground dry matter content (**DMC_a**) was calculated as the ratio between BM_a and the aboveground fresh biomass (the sum of the fresh biomasses of the green leaves and stems and litter).

On each plot, three 1m-deep and 1 m-wide trenches were dug perpendicularly to the plantation rows. Root impacts on the vertical soil profile were counted on a 10 cm × 10 cm mesh grid. The root impact density in each 10 cm soil layer from 0 to 60 cm (**RID_{i-i+10}**, with i in {0, 10, 20, 30, 40, 50}) was calculated as the number of root impacts /dm² in this layer, averaged over the three profiles. The mean root impact density on the whole soil profile (**RID_{mean}**) was calculated as mean of all RID_{i-i+10}. The mean rooting depth (**RD**) was calculated as the mean of the soil layer depths weighted by the RID_{i-i+10}:

$$RD = \frac{\sum_i (i + 5) \cdot RID_{i-i+10}}{\sum_i RID_{i-i+10}} \text{ within } \{0, 10, 20, 30, 40, 50\}$$

RD was averaged over the three soil profiles.

Three individuals well-developed and free of pest or disease damage were chosen within the plot population. Their aboveground organs were collected and pooled to describe the "mean plant" of the population. Their root systems were carefully extracted from the soil and similarly pooled. The presence of nodules (**Nod**) was observed before washing above a 2 mm sieve to eliminate soil particles. The aboveground organs and the roots were oven-dried separately at 70 °C for 72 h, and weighted. The plant root dry biomass (**BM_r**) was calculated as the mean dry biomass for one individual (harvested roots dry biomass divided by 3). The shoot/root ratio (**SRR**)

was calculated as the ratio between the plant aboveground dry biomass and the plant root dry biomass.

Samples of aboveground organs and roots were then taken for chemical analysis. Total carbon and nitrogen contents on a mass basis ($[C]_a$ and $[N]_a$ for the aboveground organs, $[C]_r$ and $[N]_r$ for the roots) were determined according to Dumas method, using a CHN analyser (Elementar Vario Macro Cube). Phosphorus, potassium, magnesium and calcium contents on a mass basis ($[P]_a$, $[K]_a$, $[Mg]_a$ and $[Ca]_a$ for the aboveground organs, $[P]_r$, $[K]_r$, $[Mg]_r$ and $[Ca]_r$ for the roots) were determined by inductively coupled plasma atomic emission spectroscopy (ICP-AES) (Agilent 720) after sample mineralization by double calcination and HF addition for SiO_2 removal. The C/N ratio of the aboveground organs and of the roots (respectively CN_a and CN_r) were calculated.

The quantity of nitrogen in the aboveground organs (QN_a) and in the whole plant (QN) were calculated:

$$QN_a = BM_a \cdot [N]_a / 100$$

$$QN = QN_a + d_{\text{Plant}} \cdot (BM_r \cdot [N]_r) / 100$$

Seed fresh mass (SM) was determined after counting the number of seeds present in a 500 mg - 1 g sample.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

CRedit authorship contribution statement

Gaëlle Damour: Formal analysis, Funding acquisition, Data curation, Writing - review & editing. **Charles Meynard:** Funding acquisition, Data curation, Formal analysis. **Steevy Lakhia:** Funding acquisition, Data curation, Formal analysis. **Mylène Ramassamy:** Funding acquisition, Data curation, Formal analysis. **Kelly Lakhia:** Funding acquisition, Data curation, Formal analysis. **Marc Dorel:** Methodology, Funding acquisition, Data curation, Supervision.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.dib.2020.105808](https://doi.org/10.1016/j.dib.2020.105808).

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