

DAPHNE: A GENERIC DATABASE TO INTEGRATE MULTISCALE AGRONOMIC AND PHENOTYPIC INFORMATION FOR CROP MODELLING

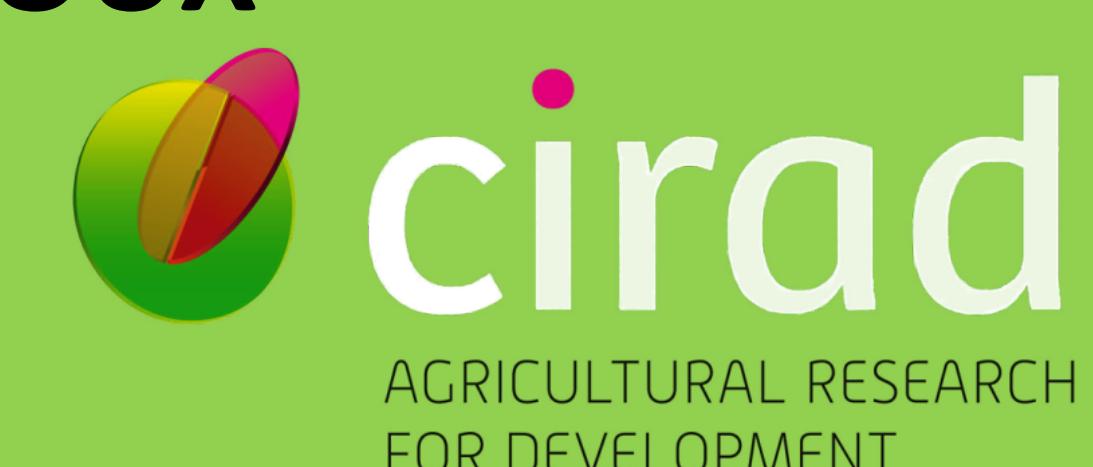
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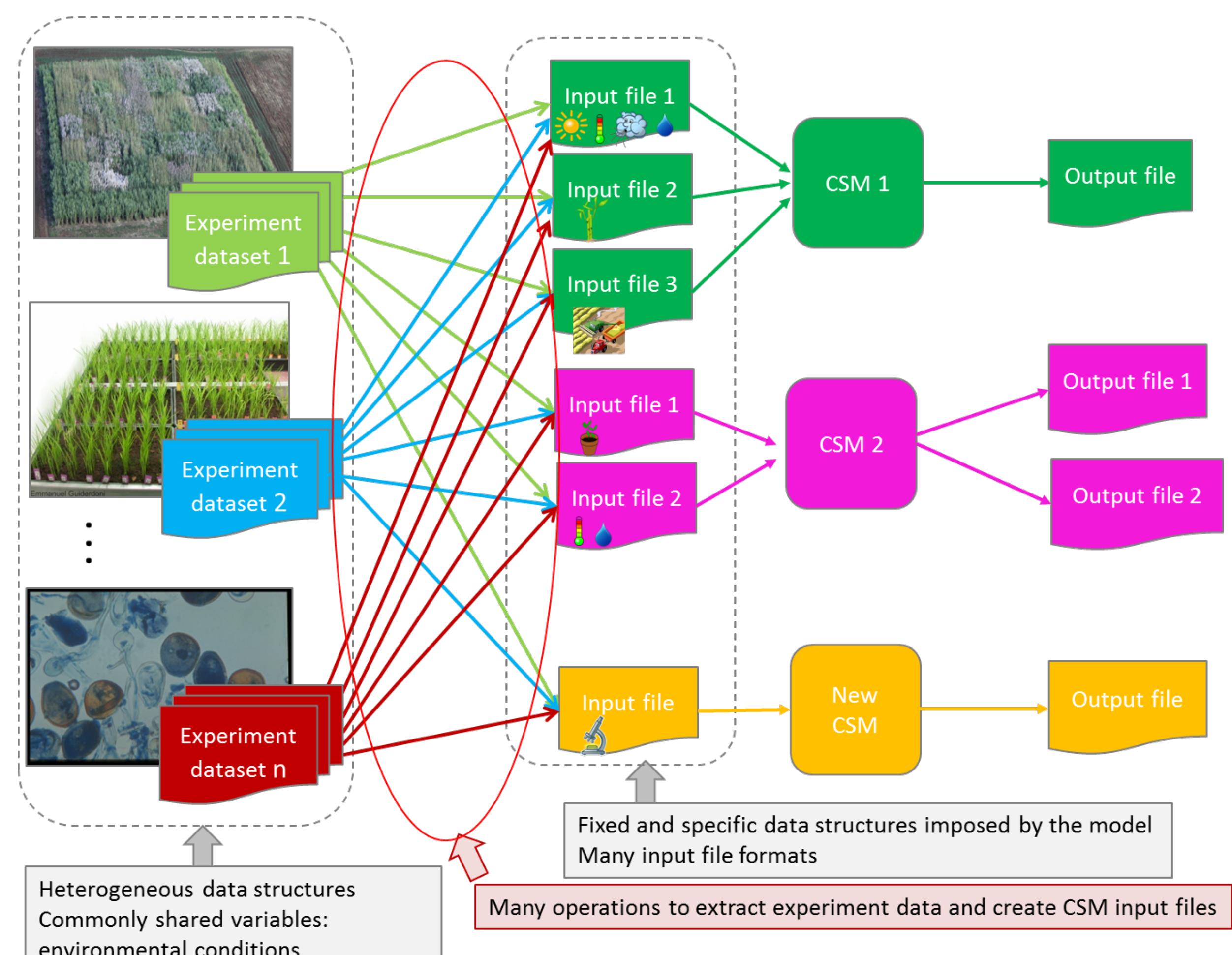
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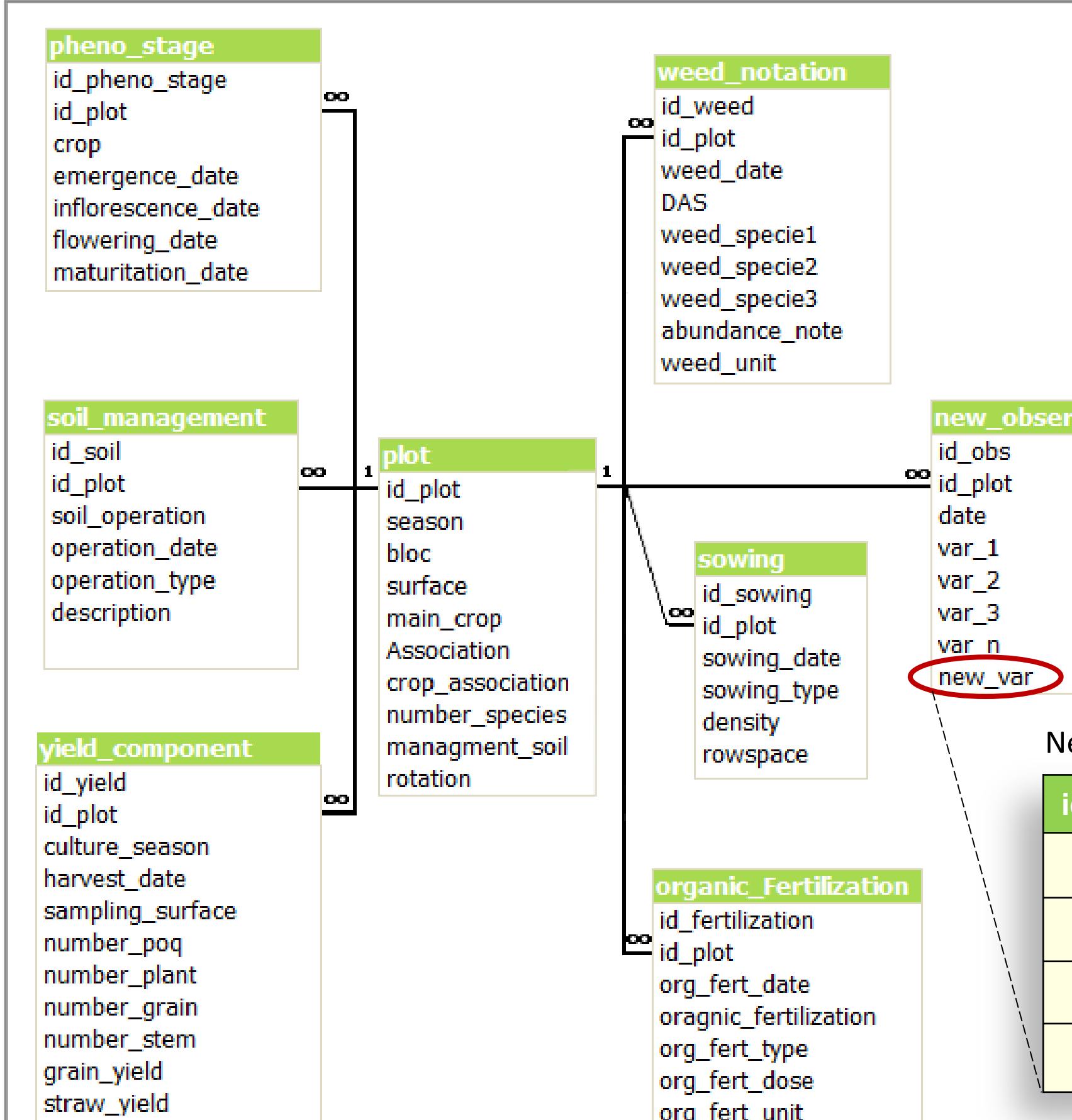
Studies of genotype x environment x management (GXEXM) interactions commonly use Crop Simulation Models (CSM). Each model requires reliable minimum datasets (MD) for its successful implementation [1][3]. These MD are collected separately and can be multi-scale, multi-species, multi-disciplinary (agronomy, entomology, phytopathology, weed science, etc.). Data manipulation is tedious and difficult to automate for modelling. All these problems can be solved using database technology [2].

Analysis of CSM input files and field experiment datasets



Analysis of a standard agronomic database

Extract of a standard database schema



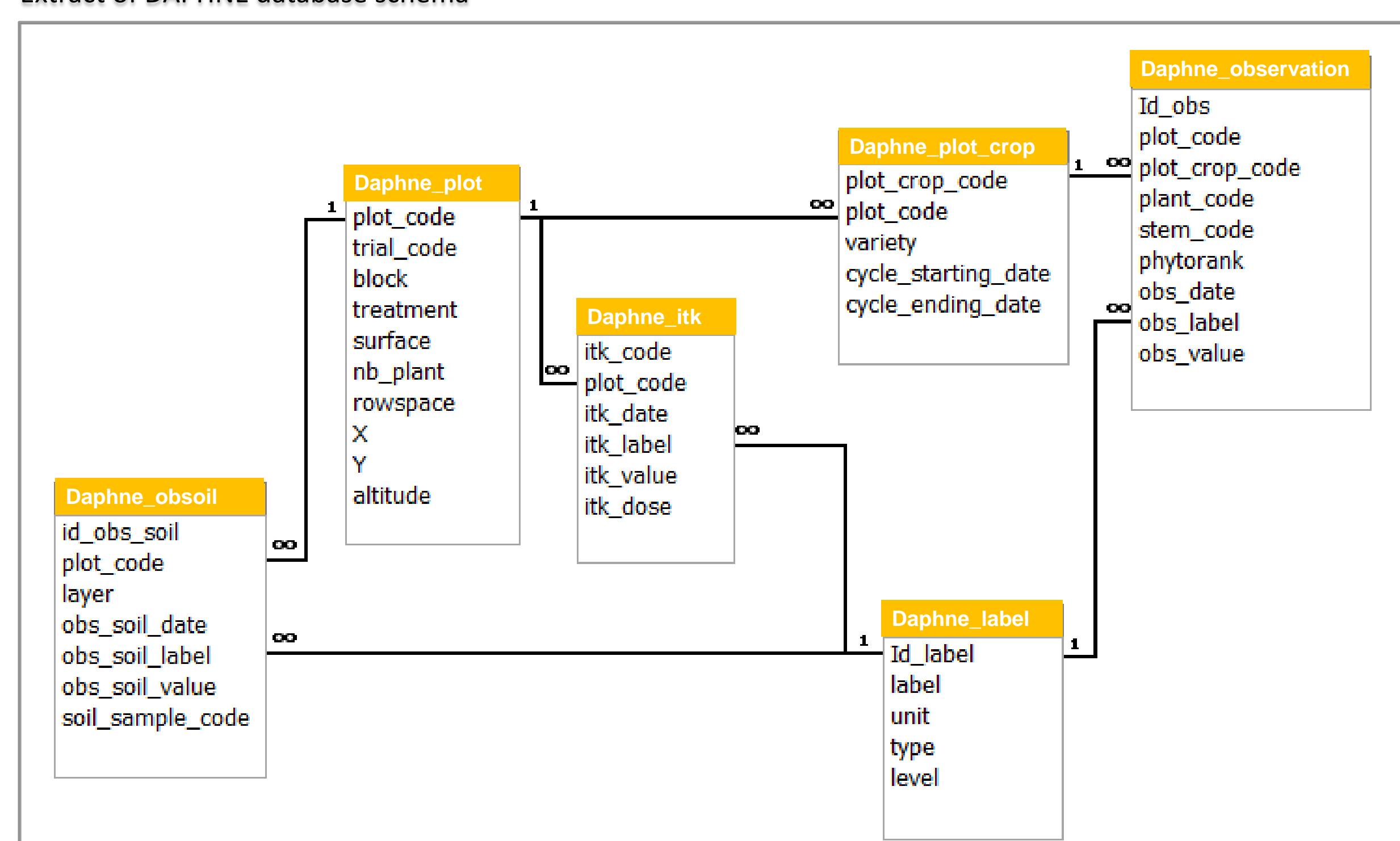
In standard databases, adding a new variable involves either adding a new column or creating a new table.

New observation table

id_obs	date	var 1	var 2	var 3	...	var n	new var
A	01/01/2015	1.5	150		...		1.3
A	02/01/2015	2.0		58	...	F1	1.9
B	01/01/2015	1.8	147		...		1.2
B	02/01/2015	1.9			...	F2	1.7

DAPHNE database structure

Extract of DAPHNE database schema



Metadata and methodology

2 Observation table

id_obs	obs_date	obs_label	obs_value
A	01/01/2015	var 1	1.5
A	01/01/2015	var 2	150
A	02/01/2015	var 1	2.0
A	02/01/2015	var 3	58
A	02/01/2015	var n	F1
B	01/01/2015	var 1	1.8
B	01/01/2015	var 2	147
B	02/01/2015	var 1	1.9
B	02/01/2015	var n	F2
A	01/01/2015	new var	1.3
A	02/01/2015	new var	1.9
B	01/01/2015	new var	1.2
B	02/01/2015	new var	1.7

The relational data model includes:

- ✓ The environmental conditions of the experiment,
- ✓ The cropping practices,
- ✓ The agronomic measurements.

The advantages of this methodology:

- ✓ The database schema doesn't require to be modified.
- ✓ Number of tables, columns and empty cells is minimized.
- ✓ Improve database query performance for data mining.

Conclusion

DAPHNE is a performant optimized database that improves analysis and facilitates access to data for CSM. Genericness of database schema can allow intercomparison of CSM (AgMIP) that require the same datasets with no common data structure. DAPHNE has a wide application in pest management, plant disease and ecophysiological experiments on sugarcane, cotton and sorghum in Africa and Central America.

References

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Hunt, L.A., J.W. White, G. Hoogenboom (2001). Agricultural Systems, 70 (2): 477-492

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