Hive Master

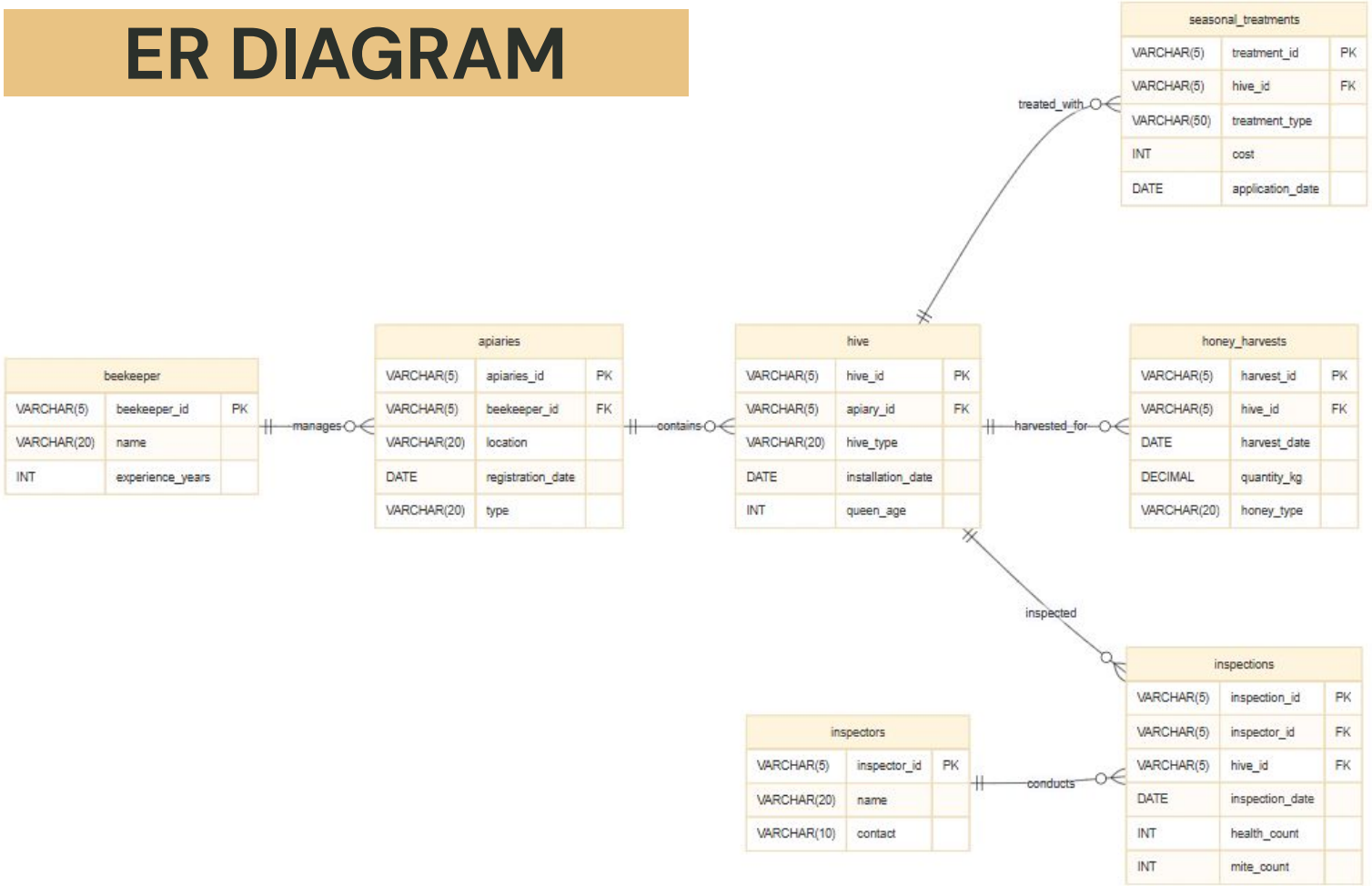
A Honey Harvesting Initiative

ABSTRACT

HiveMaster: A Honey Harvesting Initiative explores modern apiary operations through an integrated beekeeping data programme. This project models the full lifecycle of commercial and hobby apiaries, mapped for commercial purposes. HiveMaster enables granular analysis of productivity, hive health, treatment costs, and seasonal performance across diverse apiary environments.

Total **8124.10 kgs** of honey harvested
from **July 22, 2020** to **December 31, 2024**
Average **25.38 kgs** of honey harvested per harvest

ER DIAGRAM


seasonal_treatments
VARCHAR(5) treatment_id PK
VARCHAR(5) hive_id FK
VARCHAR(50) treatment_type
INT cost
DATE application_date
treated_with
beekeeper
VARCHAR(5) beekeeper_id PK
VARCHAR(20) name
INT experience_years
manages
apiaries
VARCHAR(5) apiaries_id PK
VARCHAR(5) beekeeper_id FK
VARCHAR(20) location
DATE registration_date
VARCHAR(20) type
contains
hive
VARCHAR(5) hive_id PK
VARCHAR(5) apiary_id FK
VARCHAR(20) hive_type
DATE installation_date
INT queen_age
harvested_for
honey_harvests
VARCHAR(5) harvest_id PK
VARCHAR(5) hive_id FK
DATE harvest_date
DECIMAL quantity_kg
VARCHAR(20) honey_type
inspected
inspections
VARCHAR(5) inspection_id PK
VARCHAR(5) inspector_id FK
VARCHAR(5) hive_id FK
DATE inspection_date
INT health_count
INT mite_count
inspectors
VARCHAR(5) inspector_id PK
VARCHAR(20) name
VARCHAR(10) contact
conducts

01

STRUCTURE OF TABLES

Syntax: DESC tablename;

DESC BEEKEEPER;

Stores the beekeeper's unique ID, their names and their experience years.

	Field	Type	Null	Key	Default	Extra
▶	beekeeper_id	varchar(5)	NO	PRI	NULL	
	name	varchar(20)	NO		NULL	
	experience_years	int	YES		NULL	

DESC APIARIES;

Stores the apiaries' unique ID, their location and their registration dates, the particular type and the ID of beekeeper responsible to maintain it.

Field	Type	Null	Key	Default	Extra
apiary_id	varchar(5)	NO	PRI	NULL	
beekeeper_id	varchar(5)	YES	MUL	NULL	
location	varchar(20)	YES		NULL	
registration_date	date	YES		NULL	
type	varchar(20)	YES		NULL	

DESC HIVE;

Stores the hive's unique ID, the apiary ID that the hive belongs to, the type of hive, installation date of the hive, and the age of the queen of the particular hive.

Field	Type	Null	Key	Default	Extra
hive_id	varchar(5)	NO	PRI	NULL	
apiary_id	varchar(5)	YES	MUL	NULL	
hive_type	varchar(20)	NO		NULL	
installation_date	date	NO		NULL	
queen_age	int	NO		NULL	

DESC INSPECTORS;

Stores a uniquely identifying ID of each inspector, their name and their contact

Field	Type	Null	Key	Default	Extra
inspector_id	varchar(5)	NO	PRI	NULL	
name	varchar(20)	YES		NULL	
contact	varchar(10)	YES		NULL	

DESC INSPECTIONS;

Stores a unique Inspection ID, the ID of the inspector that's conducting the inspection, the ID of the hive that's being inspected, the date of the inspection, total health count out of 100, and mite count.

Field	Type	Null	Key	Default	Extra
inspection_id	varchar(6)	NO	PRI	NULL	
inspector_id	varchar(5)	YES	MUL	NULL	
hive_id	varchar(5)	YES	MUL	NULL	
inspection_date	date	NO		NULL	
health_count	int	YES		NULL	
mite_count	int	YES		0	

DESC SEASONAL_TREATMENTS;

Stores a unique treatment ID, the ID of the hive that is treated, the type of treatment, cost of the treatment and the application date.

Field	Type	Null	Key	Default	Extra
treatment_id	varchar(5)	NO	PRI	NULL	
hive_id	varchar(5)	YES	MUL	NULL	
treatment_type	varchar(50)	YES		NULL	
cost	int	YES		NULL	
application_date	date	NO		NULL	

DESC HONEY_HARVESTS;

Stores a unique harvest ID, the ID of the hive being harvested, date of harvest, how much honey is harvested in kgs and the type of honey that is harvested.

Field	Type	Null	Key	Default	Extra
harvest_id	varchar(5)	NO	PRI	NULL	
hive_id	varchar(5)	YES	MUL	NULL	
harvest_date	date	NO		NULL	
quantity_kg	decimal(5,2)	YES		NULL	
honey_type	varchar(20)	NO		NULL	

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CONTENTS OF TABLES

Syntax: SELECT * FROM tablename;

SELECT * FROM BEEKEEPER;

beekeeper_id	name	experience_years
BK001	John Miller	15
BK002	Sarah Johnson	8
BK003	Michael Brown	22
BK004	Emily Davis	12
BK005	Robert Wilson	18
BK006	Lisa Anderson	6
BK007	David Thompson	25
BK008	Jennifer Garcia	9
BK009	Christopher Lee	14
BK010	Amanda Martinez	11
BK011	James Rodriguez	20
BK012	Michelle Taylor	7
BK013	Daniel Moore	16
BK014	Jessica White	13
BK015	Mark Jackson	19
BK016	Rachel Green	5
BK017	Steven Clark	24
BK018	Karen Lewis	10
BK019	Paul Walker	21
BK020	Stephanie Hall	8

35 rows

SELECT * FROM APIARIES;

apiary_id	beekeeper_id	location	registration_date	type
AP001	BK001	Meadowbrook Farm	2020-08-15	Commercial
AP002	BK001	Sunset Valley	2021-03-20	Hobby
AP003	BK001	Pine Ridge	2022-01-10	Commercial
AP004	BK002	Clover Fields	2020-09-05	Hobby
AP005	BK002	Wildflower Meadow	2021-05-12	Hobby
AP006	BK003	Golden Acres	2020-07-22	Commercial
AP007	BK003	Honey Hills	2021-02-14	Commercial
AP008	BK003	Maple Grove	2022-06-30	Commercial
AP009	BK004	Lavender Fields	2020-10-18	Hobby
AP010	BK004	Rosemary Garden	2021-08-25	Hobby
AP011	BK005	Oakwood Valley	2020-11-12	Commercial
AP012	BK005	Cedar Point	2021-04-07	Commercial
AP013	BK005	Birch Creek	2022-09-15	Commercial
AP014	BK006	Daisy Hollow	2021-01-30	Hobby
AP015	BK006	Sunflower Ridge	2022-03-18	Hobby
AP016	BK007	Heritage Farms	2020-12-08	Commercial
AP017	BK007	Prairie Winds	2021-07-16	Commercial
AP018	BK007	Spring Valley	2022-11-22	Commercial
AP019	BK008	Butterfly Gardens	2021-02-28	Hobby
AP020	BK008	Thistle Creek	2022-05-14	Hobby

72 rows

SELECT * FROM HIVE;

hive_id	apiary_id	hive_type	installation_date	queen_age
HV001	AP001	Langstroth	2020-08-20	18
HV002	AP001	Langstroth	2020-09-15	17
HV003	AP001	Langstroth	2021-05-10	16
HV004	AP001	Top Bar	2022-03-25	15
HV005	AP002	Top Bar	2021-04-05	18
HV006	AP002	Langstroth	2021-06-20	17
HV007	AP002	Warre	2022-08-14	14
HV008	AP003	Langstroth	2022-02-18	19
HV009	AP003	Langstroth	2022-04-12	18
HV010	AP003	Langstroth	2023-01-30	12
HV011	AP004	Top Bar	2020-09-20	18
HV012	AP004	Top Bar	2021-02-15	17
HV013	AP004	Langstroth	2021-07-08	16
HV014	AP005	Warre	2021-05-25	18
HV015	AP005	Langstroth	2021-08-10	17
HV016	AP005	Top Bar	2022-11-22	13
HV017	AP006	Langstroth	2020-08-05	19
HV018	AP006	Langstroth	2020-10-18	18
HV019	AP006	Langstroth	2021-03-14	17
HV020	AP006	Langstroth	2021-09-07	16

198 rows

SELECT * FROM INSPECTORS;

inspector_id	name	contact
IN001	Dr. Henry Walsh	5551234567
IN002	Maria Santos	5552345678
IN003	Robert Kim	5553456789
IN004	Jennifer Liu	5554567890
IN005	Michael Chen	5555678901
IN006	Sarah Ahmed	5556789012
IN007	David Patel	5557890123
IN008	Lisa Thompson	5558901234
IN009	James Wilson	5559012345
IN010	Amanda Foster	5550123456
IN011	Kevin Zhang	5551235678
IN012	Rachel Cohen	5552346789
NULL	NULL	NULL

12 rows

SELECT * FROM INSPECTIONS;

inspection_id	inspector_id	hive_id	inspection_date	health_count	mite_count
INS001	IN001	HV001	2021-05-15	85	2
INS002	IN001	HV002	2021-05-15	78	4
INS003	IN001	HV003	2021-06-20	92	1
INS004	IN001	HV004	2022-04-10	88	3
INS005	IN001	HV005	2021-07-25	90	2
INS006	IN001	HV017	2021-04-12	95	1
INS007	IN001	HV018	2021-04-12	87	3
INS008	IN001	HV019	2021-08-18	89	2
INS009	IN001	HV020	2021-11-22	82	5
INS010	IN001	HV035	2021-02-14	91	1
INS011	IN002	HV011	2021-03-08	86	3
INS012	IN002	HV012	2021-03-08	83	4
INS013	IN002	HV013	2021-09-15	94	1
INS014	IN002	HV014	2021-08-10	89	2
INS015	IN002	HV029	2021-01-20	88	3
INS016	IN002	HV030	2021-07-05	92	1
INS017	IN002	HV031	2022-01-15	85	4
INS018	IN002	HV045	2021-05-25	90	2
INS019	IN002	HV063	2021-06-12	87	3
INS020	IN002	HV076	2021-08-30	91	1

274 rows

SELECT * FROM SEASONAL_TREATMENTS;

treatment_id	hive_id	treatment_type	cost	application_date
ST001	HV001	Oxalic Acid Vaporization	25	2021-03-15
ST002	HV002	Thymol Treatment	35	2021-03-20
ST003	HV003	Formic Acid Strips	40	2021-04-10
ST004	HV004	Antibiotic Treatment	50	2022-02-25
ST005	HV005	Oxalic Acid Vaporization	25	2021-02-28
ST006	HV006	Thymol Treatment	35	2021-06-15
ST007	HV007	Formic Acid Strips	40	2022-08-05
ST008	HV008	Oxalic Acid Vaporization	25	2022-01-20
ST009	HV009	Antibiotic Treatment	50	2022-03-15
ST010	HV010	Thymol Treatment	35	2023-01-10
ST011	HV011	Oxalic Acid Vaporization	25	2020-11-15
ST012	HV012	Formic Acid Strips	40	2021-01-20
ST013	HV013	Thymol Treatment	35	2021-06-25
ST014	HV014	Antibiotic Treatment	50	2021-04-30
ST015	HV015	Oxalic Acid Vaporization	25	2021-07-18
ST016	HV016	Thymol Treatment	35	2022-10-12
ST017	HV017	Formic Acid Strips	40	2020-09-08
ST018	HV018	Oxalic Acid Vaporization	25	2020-11-25
ST019	HV019	Antibiotic Treatment	50	2021-02-14
ST020	HV020	Thymol Treatment	35	2021-08-30

300 rows

SELECT * FROM HONEY_HARVESTS;

harvest_id	hive_id	harvest_date	quantity_kg	honey_type
HH001	HV001	2021-08-15	28.50	Wildflower
HH002	HV002	2021-08-20	24.75	Clover
HH003	HV003	2021-09-10	32.20	Wildflower
HH004	HV004	2022-07-25	19.80	Acacia
HH005	HV005	2021-09-05	26.90	Clover
HH006	HV006	2021-09-15	22.40	Wildflower
HH007	HV007	2022-08-30	18.60	Buckwheat
HH008	HV008	2022-08-12	29.30	Wildflower
HH009	HV009	2022-08-18	31.75	Clover
HH010	HV010	2023-07-20	15.20	Acacia
HH011	HV011	2021-07-28	25.80	Wildflower
HH012	HV012	2021-08-05	23.15	Clover
HH013	HV013	2021-09-22	27.60	Buckwheat
HH014	HV014	2021-08-25	24.95	Wildflower
HH015	HV015	2021-09-12	26.40	Acacia
HH016	HV016	2023-06-15	14.30	Clover
HH017	HV017	2021-08-08	35.50	Wildflower
HH018	HV018	2021-08-15	33.80	Clover
HH019	HV019	2021-09-02	30.25	Buckwheat
HH020	HV020	2021-09-18	28.70	Wildflower

320 rows

03

SUBQUERIES

1. Which top 5 hives have queens in their prime age 18 months but are underperforming compared to other hives with similar queen ages?

```
select hive_id as hive, queen_age, (select
sum(quantity_kg) from honey_harvests where
hive_id = h.hive_id) as total_harvest
from hive h
where queen_age = 18
AND
(select sum(quantity_kg) from honey_harvests where
h.hive_id = hive_id) <
   (SELECT AVG(harvest_total)
    FROM (SELECT SUM(quantity_kg) as harvest_total
        FROM honey_harvests hh2
        INNER JOIN hive h2 ON hh2.hive_id = h2.hive_id
        WHERE h2.queen_age = 18
        GROUP BY h2.hive_id) as prime_age_harvests)
ORDER BY total_harvest ASC;
```

hive	queen_age	total_harvest
HV011	18	25.80
HV029	18	31.20
HV009	18	31.75
HV014	18	51.60
HV005	18	55.10
HV045	18	55.70
HV039	18	59.85
HV022	18	61.00

8 rows

2. Which beekeepers have hives that harvested more than 35 kg of honey in a single harvest?

```
select distinct name from beekeeper
where beekeeper_id in
(select beekeeper_id from apiaries where apiary_id in
(select apiary_id from hive where hive_id in
(select hive_id from honey_harvests where
quantity_kg > 35)));
```

name
Michael Brown
Robert Wilson
David Thompson
Christopher Lee
James Rodriguez
Mark Jackson
Steven Clark
Brian Scott
Thomas Phillips
Andrew Turner

10 rows

3. Which top 5 hives have received more expensive treatments than the average cost for hives in their health score range?

```
SELECT hive_id,(SELECT SUM(cost) FROM
seasonal_treatments WHERE hive_id = h.hive_id) as
treatment_cost,
                (SELECT AVG(health_count) FROM
inspections WHERE hive_id = h.hive_id) as
health_score
FROM hive h
WHERE (SELECT SUM(cost) FROM
seasonal_treatments WHERE hive_id = h.hive_id) >
        (SELECT AVG(cost) FROM
seasonal_treatments)
    AND
    (SELECT COUNT(*) FROM inspections WHERE
hive_id = h.hive_id) > 1
ORDER BY treatment_cost DESC
LIMIT 5;
```

hive_id	treatment_cost	health_score
HV032	100	80.5000
HV004	100	86.0000
HV014	90	89.0000
HV012	90	84.0000
HV040	90	83.5000

5 rows

4. Which beekeepers have an apiary where all hives' latest inspections show mite_count below 3?

```
SELECT DISTINCT b.name as beekeepers
FROM beekeeper b
INNER JOIN apiaries a ON b.beekeeper_id =
a.beekeeper_id
WHERE a.apiary_id NOT IN (
   SELECT a2.apiary_id
   FROM apiaries a2
   INNER JOIN hive h ON a2.apiary_id = h.apiary_id
   WHERE h.hive_id IN (
      SELECT hive_id
      FROM inspections
      WHERE mite_count >= 3 )
);
```

beekeepers
Melissa Collins
Ryan Murphy
Laura Cooper
Jason Reed
Kimberly Cook
Eric Bailey

6 rows

04

JOINS

1. Which 5 hives had the lowest health scores between July 2023–2024, and which inspectors identified these issues?

```
select h.hive_id as hive, inrs.name as inspector,
ins.health_count as health_score
from hive h
inner join inspections ins on h.hive_id = ins.hive_id
inner join inspectors inrs on ins.inspector_id =
inrs.inspector_id
where ins.inspection_date between '2023-07-01'
and '2024-07-31'
order by ins.health_count, h.hive_id limit 5;
```

hive	inspector	health_score
HV136	Kevin Zhang	64
HV087	Amanda Foster	65
HV099	Rachel Cohen	65
HV190	James Wilson	65
HV078	James Wilson	66

5 rows

2. Show apiaries created in 2024, with their beekeeper, location, number of hives, and most common hive type.

```
select distinct(a.apiary_id) as apiary, b.name as
beekeeper, a.location, count(h.hive_id) as
number_of_hives,
(select h.hive_type from hive h where h.apiary_id =
a.apiary_id
group by hive_type
order by count(*) desc limit 1) as
common_hive_type
from apiaries a
inner join beekeeper b on a.beekeeper_id =
b.beekeeper_id
left join hive h on a.apiary_id = h.apiary_id
where registration_date between '2024-01-01' and
'2024-12-31'
group by a.apiary_id;
```

apiary	beekeeper	location	number_of_hives	common_hive_type
AP052	Brian Scott	Ice Creek	2	Langstroth
AP054	Nicole Adams	Sandy Shore	2	Langstroth
AP061	Crystal Evans	Pearl Harbor	2	Langstroth
AP065	Melissa Collins	Topaz Creek	0	NULL
AP068	Laura Cooper	Garnet Grove	0	NULL

5 rows

3. Which hives received a treatment and inspection in the same month? Show the treatment, treatment date, inspection date, and inspector.

```
select h.hive_id as hive, s.treatment_type, s.application_date, ins.inspection_date, inrs.name as inspector
from hive h
inner join seasonal_treatments s on h.hive_id = s.hive_id
inner join inspections ins on h.hive_id = ins.hive_id
inner join inspectors inrs on ins.inspector_id = inrs.inspector_id
where year(ins.inspection_date) = year(s.application_date)
and month(ins.inspection_date) = month(s.application_date);
```

hive	treatment_type	application_date	inspection_date	inspector
HV072	Antibiotic Treatment	2024-01-05	2024-01-12	David Patel
HV074	Formic Acid Strips	2024-05-08	2024-05-15	Lisa Thompson
HV077	Thymol Treatment	2024-03-30	2024-03-20	Lisa Thompson
HV085	Thymol Treatment	2024-04-18	2024-04-18	James Wilson
HV052	Antibiotic Treatment	2023-01-10	2023-01-25	Amanda Foster
HV087	Oxalic Acid Vaporization	2024-07-22	2024-07-25	Amanda Foster
HV063	Oxalic Acid Vaporization	2023-01-08	2023-01-18	Kevin Zhang

7 rows

4. Which hives were installed in the same apiary within 60 days (approx. 2 months) of each other?

```
SELECT
   h1.hive_id as first_hive, h2.hive_id as second_hive, h1.installation_date as first_install_date,
h2.installation_date as second_install_date,
   ABS(DATEDIFF(h1.installation_date, h2.installation_date)) as days_apart, h1.apiary_id
FROM hive h1
INNER JOIN hive h2 ON h1.apiary_id = h2.apiary_id
            AND h1.hive_id != h2.hive_id
            AND h1.hive_id < h2.hive_id
WHERE ABS(DATEDIFF(h1.installation_date, h2.installation_date)) <= 60
ORDER BY h1.apiary_id, days_apart;
```

first_hive	second_hive	first_install_date	second_install_date	days_apart	apiary_id
HV001	HV002	2020-08-20	2020-09-15	26	AP001
HV008	HV009	2022-02-18	2022-04-12	53	AP003
HV035	HV036	2020-11-28	2021-01-15	48	AP011

3 rows

Thank you!

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