Surveillance of antibiotic Use and antibiotic residues in dairy sector

J P S GILL
DIRECTOR OF RESEARCH
GURU ANGAD DEV VETERINARY & ANIMAL SCIENCES UNIVERSITY
Ludhiana

Surveillance of antibiotic use

- Although antibiotic residues in milk are an indicator that the animal had been provided with antibiotic drugs

  - No information on the indication for which the medication was given,
  - who prescribed it,
  - what duration the medication was given for,
  - what dosage the medication was given in,
  - and whether the use of antibiotics in that particular instance was justified or not.

- Hence, in the absence of more robust antibiotic consumption surveillance, it is difficult to elicit data on antibiotic consumption specific to the dairy industry.

Knowledge, attitudes and practices of dairy farmers of Punjab towards antibiotic usage in dairy herds

Disease history in the last 6 months among rural and peri-urban dairy farms

	Number of disease events	
Disease	No	%
Mastitis	13	35.1
Diarrhea	4	10.8
Laminitis	4	10.8
Pneumonia	4	10.8
Haemorrhagic Septicaemia	3	8.1
Sore throat	1	2.7
Poisoning	1	2.7

Type of treatment given to animals

	Number of disease events (n=37)	
Type of treatment	**No.**	**%**
Antibiotic	18	52.9
Cleaning	12	8.8
Vaccination	4	11.8
As prescribed by veterinarian	10	29.4
No treatment	1	2.9
Don’t remember	2	5.9
Missing	3	

Reasons for antibiotic usage and their types

	Number of farms	
Types of medicines given to animals	**No.**	**%**
Ayurvedic	16	53.3
Homeopathic	15	50.0
Allopathic	30	100.0
Antibiotics	30	100.0
Reasons for antibiotic use		
Treat disease	30	100.0
Prevent disease	2	6.7
Treat perceived general weakness of animals	1	3.3

Antibiotic usage in dairy farms

	Number of farms	
Classes of antibiotics given	No.	%
Tetracyclines	25	83.3
Fluoroquinolones	22	73.3
Cephalosporins	14	46.7
Beta lactams	14	46.7
Aminoglycosides	5	16.7
Sulfonamides	2	6.7
Amino glycoside + beta lactam	5	16.7
Aminoglycoside + beta lactam + sulfonamide	1	3.3
Don’t know	2	6.7

Response of dairy farmers to practices based questions

Questions	Farm type	Response (%)				
Who administer antibiotics to your cattle?		Veterinarian	Owner	Farm worker		
	Large	70	22	8		
	Medium	74.5	16	9		
	Small	89	8	3		
If antibiotics are not administered by veterinarian, then from whom you usually get advice?		Veterinarian	Chemist	When I see symptoms or disease condition in cattle I do myself		
	Large	64	6	30		
	Medium	69	9	22		
	Small	65.5	25.4	10		
Following the administration of an antibiotic, is the course of treatment completed		Always	Sometimes	Never		
	Large	64	24	12		
	Medium	56.3	32.7	11		
	Small	54	41	5		
What do you do with the milk of antibiotic treated animal?		Continue selling it	Consumed by family	Throw it away	Feed to calves	Feed to guard dogs
	Large	38	4	5	42	6
	Medium	65	7.3	10	16.4	5.5
	Small	52	11.4	7	18	17.8
Do you give medicated feed to your animal		Yes		No		
	Large	0		100		
	Medium	0		100		

Response of dairy farmers to knowledge based questions

Questions	Farm type	N	% Yes response
Do you know what an antibiotic is?	Large Medium Small	50 55 61	44.0 20.0 18.0
Do you know that antibiotics appear in the milk of treated animal?	Large Medium Small	50 55 61	34.0 17.0 13.0
Do you know about health hazards associated with consumption of milk containing antibiotic residues?	Large Medium Small	50 55 61	76.0 45.5 42.6
Do you know about antibiotic resistance	Large Medium Small	50 55 61	0 0 0
Do you know about withdrawal period of antibiotics?	Large Medium Small	50 55 61	48.0 29.0 27.9
Do you know about maximum residue limit?	Large Medium	50 55	0 0

Response of dairy farmers to attitudes based questions

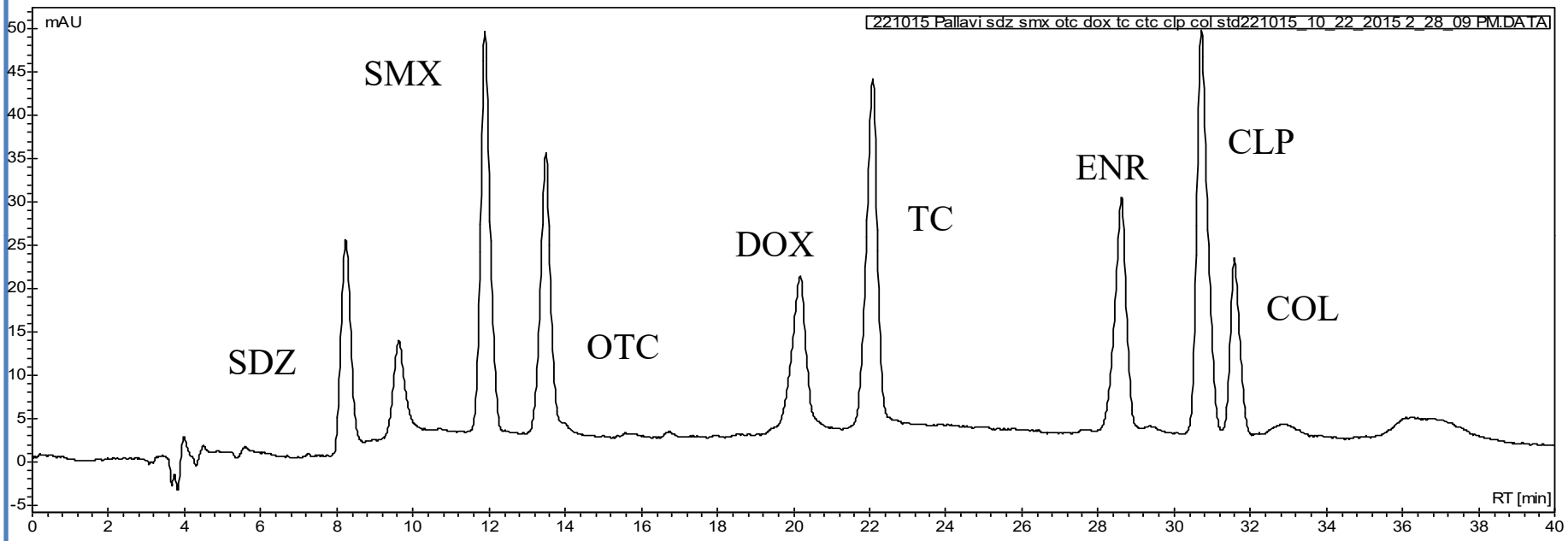
Questions	Farm type	N	% Yes response
Do you think veterinarian should be consulted before administering antibiotics to animals?	Large Medium Small	50 55 61	70.0 56.4 82.0
Does the cost of antibiotic matter to you while purchasing?	Large Medium Small	50 55 61	28.0 58.2 67.2
Do you think maintenance of treatment records of animals are essential?	Large Medium Small	50 55 61	76.0 34.6 29.5
Do you think milk from antibiotic treated cows should be mixed with milk of untreated ones?	Large Medium Small	50 55 61	16.0 29.3 37.7
Do you think antibiotic samples received from medical representatives should be used in cattle?	Large Medium Small	50 55 61	10.0 14.6 18.0

Questions	Farm type	N	% Yes response
Does the farm maintain written records for treating sick animals with antibiotics?	Large Medium Small	50 55 61	54.0 26.0 17.5
Are treated cows physically separated from untreated one?	Large Medium Small	50 55 61	22.0 21.9 18.4
Are treated cows milked separately from untreated ones?	Large Medium Small	50 55 61	78.0 47.3 50.8
Are treated cows milked with a separate milking unit?	Large Medium Small	50 55 61	4.0 1.8 0.0
Do you follow withdrawal period for antibiotics?	Large Medium Small	50 55 61	56.0 38.1 31.1
Is practice of extra label use of antibiotics followed?	Large Medium Small	50 55 61	16.3 18.7 23.0

Antibiotic Residues Surveillance Challenges

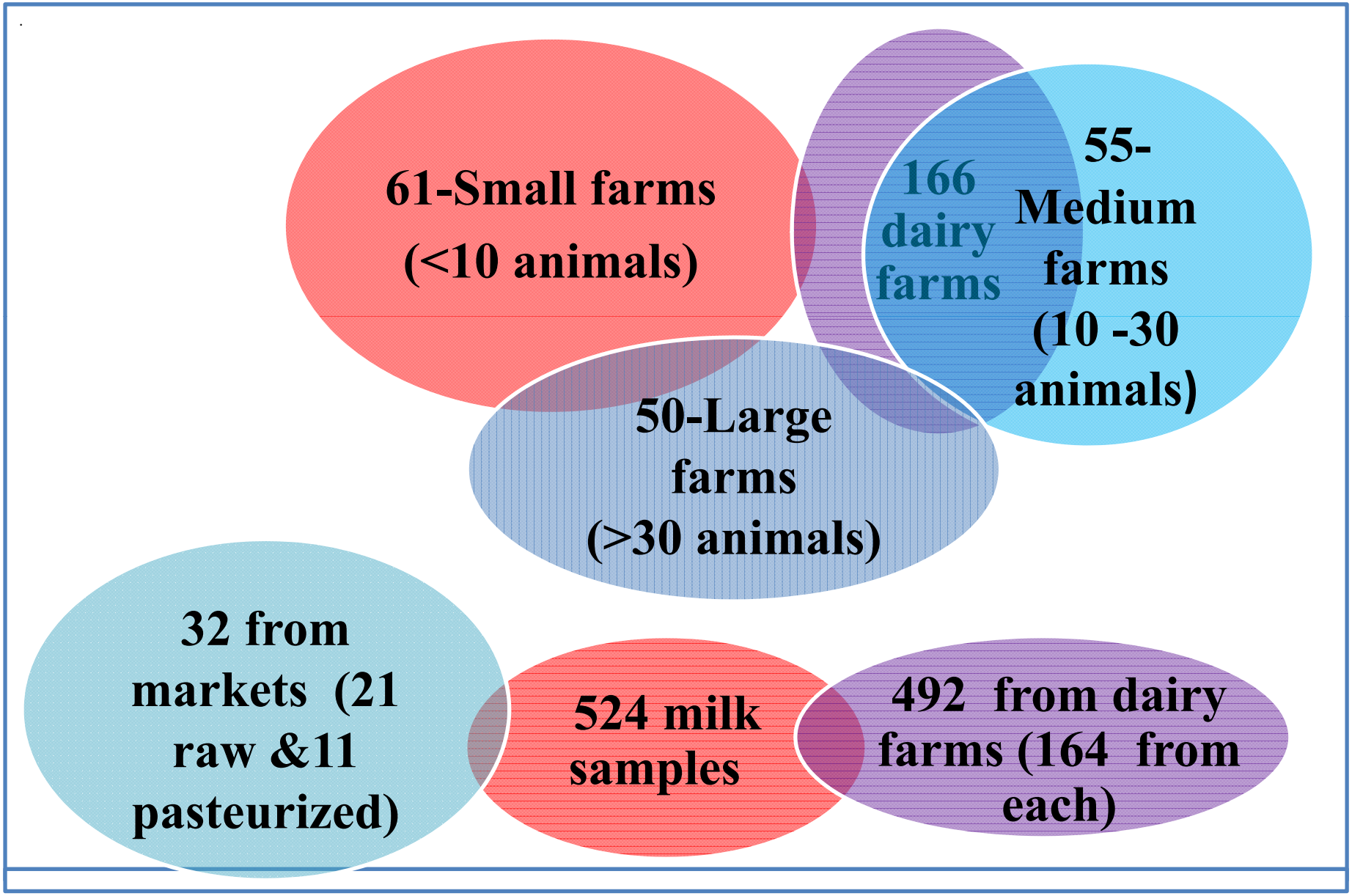
- **Elisa kits results qualitativeone**
- **HPLC tests very costly**
- **Can test on antibiotic at one time**
- **Need for Standardization of HPLC method for detection of multi-residues of antibiotic in milk**

Groups	Antibiotics
Tetracycline	Oxytetracycline (OTC)
	Tetracycline (TC)
	Doxycycline (DOX)
Fluoroquinolone	Enrofloxacin (ENR)
Sulphonamide	Sulfamethoxazole (SMX)
	Sulfadiazine (SDZ)
Amphenicol	Chloramphenicol (CLP)



Chromatogram of Multiresidues in milk

Dairy farms


61-Small farms (<10 animals)
166 dairy farms
55-Medium farms (10 -30 animals)
50-Large farms (>30 animals)
32 from markets (21 raw &11 pasteurized)
524 milk samples
492 from dairy farms (164 from each)

Antibiotic residues detected in milk samples of large dairy farms

Antibiotic residues	n/N	% Positive	MRL (ng/ml)	Samples above MRL
Enrofloxacin	10/164	6.1	100	2
Oxytetracycline	8/164	4.9	100	3
Tetracycline	2/164	1.2	100	Nil
Doxycycline	0/164	0	100	Nil
Sulfamethoxazole	0/164	0	100	Nil
Sulphadiazine	0/164	0	100	Nil
Chloramphenicol	0/164	0	0.3	Nil

Antibiotic residues in milk sample of medium dairy farms

Antibiotic Residues	n/N	% Positive	MRL (ng/ml)	Samples above MRL
Enrofloxacin	16/164	9.8	100	4
Oxytetracycline	7/164	4.3	100	2
Tetracycline	6/164	3.7	100	1
Doxycycline	0/164	0	100	Nil
Sulfamethoxazole	2/164	1.2	100	Nil
Sulphadiazine	0/164	0	100	Nil
Chloramphenicol	0/164	0	0.3	Nil

Antibiotic residues in milk sample of small dairy farms

Antibiotic Residues	n/N	% Positive	MRL (ng/ml)	Samples above MRL
Enrofloxacin	13/164	7.9	100	4
Oxytetracycline	6/164	3.7	100	3
Tetracycline	5/164	3.0	100	1
Doxycycline	0/164	0	100	Nil
Sulfamethoxazole	3/164	1.8	100	Nil
Sulphadiazine	0/164	0	100	Nil
Chloramphenicol	0/164	0	0.3	Nil

Antibiotic residues detected in market milk sample

Antibiotic Residues	n/N	% Positive	MRL (ng/ml)	Samples above MRL
Enrofloxacin	3/32	9.4	100	1
Oxytetracycline	1/32	3.1	100	Nil
Tetracycline	0/32	0	100	Nil
Doxycycline	0/32	0	100	Nil
Sulfamethoxazole	0/32	0	100	Nil
Sulphadiazine	0/32	0	100	Nil
Chloramphenicol	0/32	0	0.3	Nil

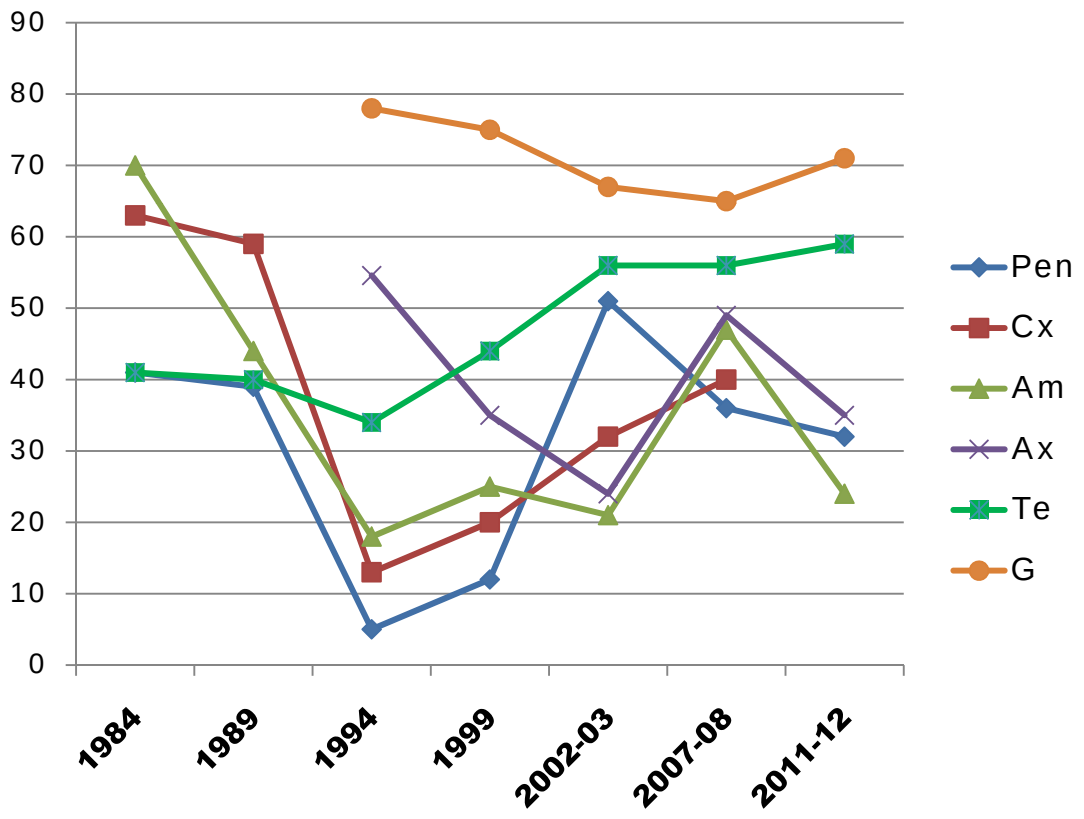
Antibiotic residues detected in large, medium and small dairy farms

Dairy farms	n/N	% Positive	Mean±SD (ng/ml)	Absolute mean±SD (ng/ml)	% Samples above MRL
Large dairy farms	20/164	12.1	86.8±34.4	10.6±30.8	3
Medium dairy farms	31/164	18.9	96.9±31.0	18.3±40.3	4.3
Small dairy farms	27/164	16.5	95.4±41.0	15.7±39.0	4.9

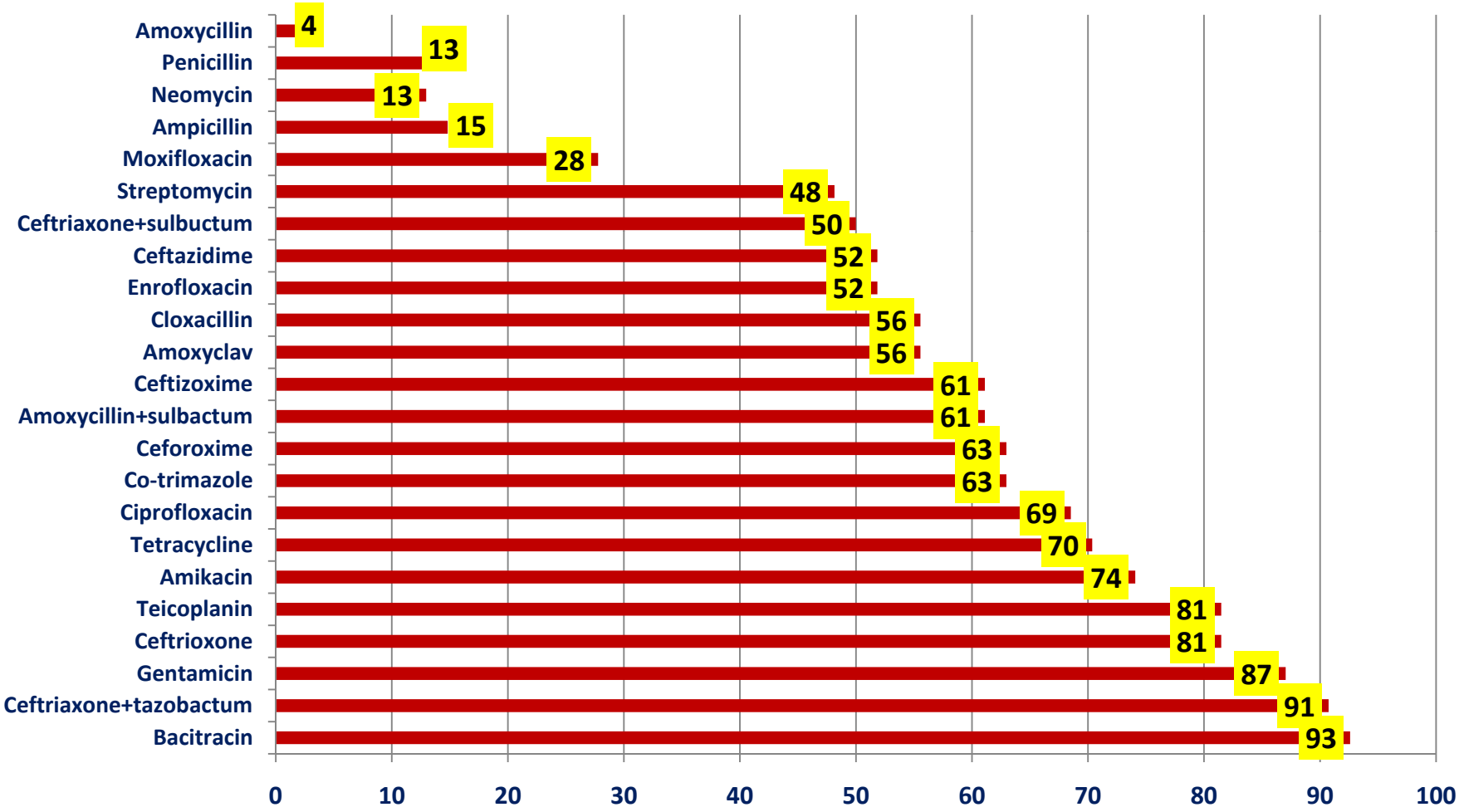
Changing drug sensitivity pattern Clinical mastitis*

*Based on >3000 milk samples from mastitis cows and buffaloes tested every year throughout state tested

- Antibiotics like ampicillin, cloxacillin and amoxicillin which were effective against more than 60% mastitis organisms in 1984, their effectiveness decreased to 20-24% in 1994.
- Tetracycline which was effective in about 35% cases in 1994 regained sensitivity of 60% in 2011.
- Gentamicin did not show much variation in sensitivity over time.



Phenotypic Drug Sensitivity of *S. aureus* isolates from clinical mastitis in dairy cows



Conclusions

- For surveillance of antibiotic usage there is need to get information from Vets, para vets, chemists; large, medium and small dairy farmers along with authorized drug dealers in the area

- For surveillance of antibiotic residues need for validation of tests for extraction and estimation of residues
  - HPLC
  - ELISA based test
  - Commercial kits

- Samples should be collected from individual animal samples from small , large and commercial farmers, pool farm milk sample, bulk milk supply, pasteurized milk

THANKS....